

# Current Science



Vol. 24, No. 1

JANUARY 1955

Pages 1-34

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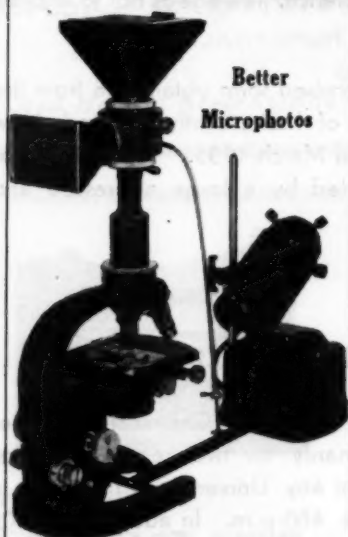
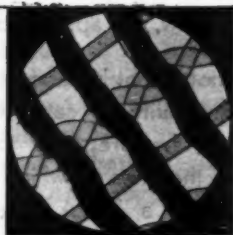
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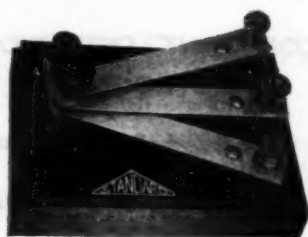
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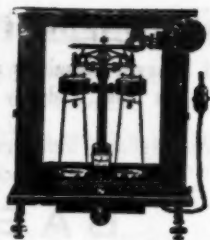


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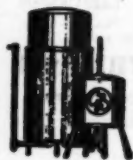
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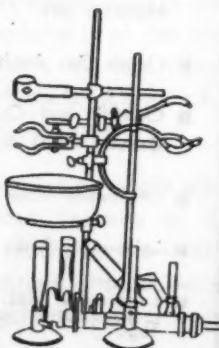
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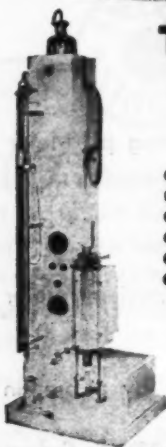
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# Current Science



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## THE LATE DR. S. S. BHATNAGAR

WE regret to record the death by heart failure of Dr. S. S. Bhatnagar, Director, Scientific and Industrial Research, Secretary, Ministry of Natural Resources and Scientific Research, and Chairman, University Grants Commission, on January 1, 1955, at New Delhi. The following tributes indicate in some measure what the people and, particularly, men of science in India owe to him.—*Editor*.

It was given to Dr. Bhatnagar to fulfil the historic mission of realising the Prime Minister's vision of putting India on the scientific map of the world, and the result can be seen today in the 12 National Laboratories which have sprung up in rapid succession between the years 1950 and 1954.

These have laid the foundations of the country's scientific development in the field of fundamental research. To translate the fruits

of research into industrial terms, he conceived the idea of a National Research Development Corporation which he was able to carry into early effect with the active assistance and support of the Prime Minister. His skill as a negotiator is evidenced by the agreements that have been concluded by the Government of India with three of the world's largest oil combines to establish up-to-date refineries in India. It was largely owing to him that a heavy media separation plant was installed in Madhya Pradesh by a leading mining concern for beneficiation of low grade manganese ore.

As Secretary of the Ministry of Education, which post he held on two occasions in addition to his other duties, he gave active support to proposals for the setting up of a school of Asian Languages in Banaras University, raising the emoluments of University Professors and teachers to attract men of the right calibre



and increased financial assistance to Universities through the University Grants Commission of which he was appointed the first Chairman.

Dr. Bhatnagar's was a rich and diverse personality compounded of learning, scientific curiosity, a keen æsthetic sense and personal charm which won him a large circle of friends. He had the gift of organization and of a quick and sound judgment. He will long be remembered for his signal service to the cause of science in India.—*Gazette of India Extraordinary*, Jan. 4, 1955.

In the sudden demise of Dr. S. S. Bhatnagar, India has lost one of its dynamic personalities in the field of science whose labour of love in the cause of scientific research enabled him to establish throughout the length and breadth of the country, National Laboratories with immense potentialities in them. Dr. Bhatnagar showed a rare combination of scientific genius with administrative efficiency and drive so much to be desired in the much-needed avenues of progress in India at present.

It was a rare coincidence that led to the discovery of Dr. Bhatnagar's abilities by the Government of India as early as 1940. He had made a mark as a Professor of Chemistry in the Lahore University by the researches that he had conducted in petroleum and allied products. A company came forward with a magnificent donation of Rs. 5 lakhs to further such research and to be utilised by Dr. Bhatnagar for the purpose. He handed over this sum to the University of Lahore just as many eminent scientists have done in the past for the furtherance of the research project which they so deeply loved.

He was largely responsible to get men of science of international repute to visit this country periodically and to quicken the interest of research workers, young and old, in many

fields of scientific activity. The meetings of the Indian Science Congress were enlivened by their presence and Dr. Bhatnagar was in his element in making their stay here both pleasant and profitable. He was connected with many institutions—the Indian Institute of Science, the Council of Scientific and Industrial Research, the several National Laboratories and many scientific associations of note. The Fellowship of the Royal Society was conferred on him in virtue of his eminence as a scientist. Just a year ago, he had taken up the very responsible task of Chairmanship of the University Grants Committee and his zeal and enthusiasm would have certainly contributed to make it an unqualified success. India in general and the scientific world in particular will bemoan the loss of one who had done so much for the furtherance of the cause of science in independent India.—*Dr. A. L. Mudaliar, Vice-Chancellor, Madras University.*

Science is to-day an integral part of modern civilization and it is Dr. Bhatnagar's unquestionable achievement that in the short space of a few years, he conceived and built in India the laboratories which are indispensable for any nation which aspires for leadership in the modern world. He has provided the means whereby the young Indian scientists of to-day and to-morrow can make their contribution to the betterment of this country and its people.

Dr. Bhatnagar was a scientist of great patriotism and zeal for his work, which he pushed forward with exceptional energy and drive. He was a warm-hearted and generous man and a good friend. Although he is no more, he will be long remembered for his great service to Indian science.—*Dr. H. J. Bhabha, Director, Tata Institute of Fundamental Research, Bombay.*

#### LADY TATA MEMORIAL TRUST SCIENTIFIC RESEARCH SCHOLARSHIPS 1955-56

THE Trustees of the Lady Tata Memorial Trust are offering six scholarships of Rs. 250 each per month for the year 1955-56 commencing from 1st July 1955. Applicants must be of Indian nationality and graduates in medicine or science of a recognized University. The scholarships are tenable in India only, and the holders must undertake to work whole-time under the direction of scientists of standing in a recognised research institute or laboratory on a

subject of scientific investigation that must have a bearing either directly or indirectly on the alleviation of human suffering from disease. Applications must conform to the instructions drawn up by the Trust. Candidates can obtain these instructions and other information they desire from the Secretary, The Lady Tata Memorial Trust, Bombay House, Bruce Street, Fort, Bombay-1.

## NEW FORMULA FOR VARIATION OF COMPRESSIVE STRENGTH WITH GRAIN ANGLE IN TIMBER

A. C. SEKHAR AND R. S. SHARMA

Forest Research Institute, Dehra Dun

THERE are various formulæ for the variation of timber strength with grain angle (i.e., with the inclination of grain to the direction of applied force in timber). F. Kollmann<sup>3</sup> suggested

$$\sigma_{\theta} = \frac{\sigma_{\perp} \cos^2 \theta + \sigma_{\parallel} \sin^2 \theta}{\cos^2 \theta + \sin^2 \theta} \quad (A)$$

where  $\sigma_{\parallel}$  = the strength value in the direction of grain,  $\sigma_{\perp}$  = strength value in the direction of perpendicular to the grain,  $\theta$  = the angle between the grain and the direction of the applied force,  $\sigma_{\theta}$  = the strength required (i.e., in the direction making an angle  $\theta$  with the grain), and  $n$  = an exponential term depending on species and varying between 2.5 and 3 for compressive stresses and between 1.5 and 2 for tensile stresses.

This above formula is referred to as Formula A in the succeeding paragraphs.

In Madison, U.S.A.<sup>1,2</sup> the Hankinson Formula, i.e., Formula A with  $n = 2$  is used for all types of stresses and species. This is referred to as Formula B in the succeeding paragraphs. Stussi<sup>4</sup> claiming a more convenient formula for designing purposes proposed

$$\sigma_{\theta} = \sigma_{\parallel} \frac{\cos^2 \theta}{\sqrt{1 + C_1 \sin^2 \theta}} + \sigma_{\perp} \frac{\sin^2 \theta}{\sqrt{1 + C_2 \cos^2 \theta}} \quad (B)$$

where  $C_1$  and  $C_2$  are two parameters and the rest are the same as above.

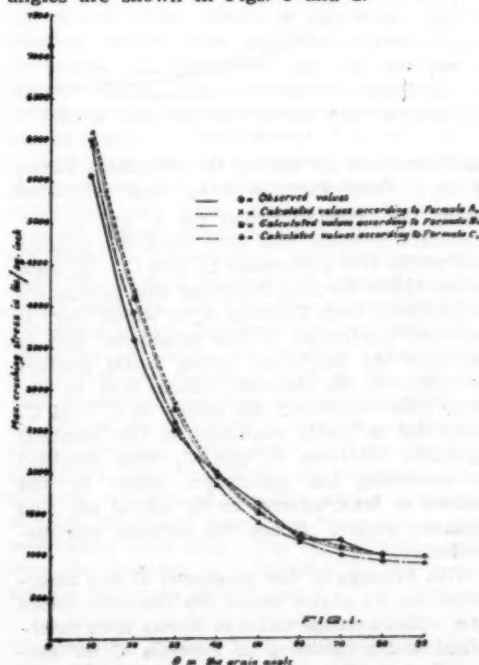
Having studied the applicability of the above formulæ for compressive stresses in *Calophyllum tomentosum* (poon), the following formula is suggested as simpler than any of the above, and may be tried for other species and stresses also.

$$\sigma_{\theta} / \sigma_{\parallel} = 1 + P \sin^2 \theta \quad (C)$$

where  $P$  is a parameter depending on the species and the stresses, and the rest are the same as above. This formula is denoted in succeeding paragraphs as Formula C.

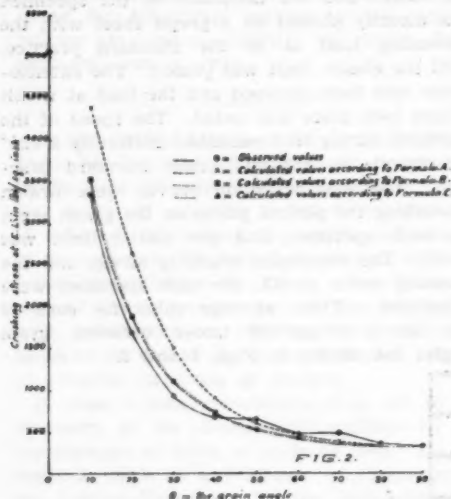
**Experimental.**—From a plank  $18'' \times 2\frac{1}{2}''$  of *Calophyllum tomentosum* (poon), standard sized specimens, each of  $2'' \times 2'' \times 8''$ , were cut at different angles to grain varying from  $0^\circ$  to  $90^\circ$  at regular intervals of  $10^\circ$ . In each group three pieces were taken. All specimens were conditioned to about to 12 per cent. moisture content. Each specimen was measured and weighed before test. A Lamb's extensometer was so adjusted to the specimen that the gauge

length was  $6''$  leaving  $1''$  at each end. Specimens were loaded for compression parallel to the length and the deflection of the specimen was directly plotted on a graph sheet with the increasing load as in the standard practice, until the elastic limit was passed. The extensometer was then removed and the load at which failure took place was noted. The speed of the machine, during test, remained uniformly  $0.024''$  per minute as required under standard practice. The load-deflection curves were drawn connecting the plotted points on the graph sheet for each specimen and the elastic limit was noted. The maximum crushing stress, and the crushing stress at E.L. for each specimen were calculated. Their average value for each of the above properties under different grain angles are shown in Figs. 1 and 2.



**Theoretical.**—In Figs. 1 and 2, the observed values and the calculated values according to the different formulæ are plotted against various angles of grain to the direction of force for maximum crushing stress and crushing

stress at E.L. In trying to evaluate the required exponential  $n$  of the formula  $A$ ,  $\sin^2\theta$  and  $\cos^2\theta$  were expanded. Approximation was made correct to the first two terms only involving  $\sin^2\theta$  and  $\cos^2\theta$ . The value of  $n$  was thus determined for all angles taking the observed values of  $\sigma_{\theta}$  and  $\sigma_{\perp}$ . The average value of  $n$  was then determined and substituted in



the Formula A for getting the calculated values of  $\sigma_{\theta}$ . From Formula B,  $\sigma_{\theta}$  was calculated taking the observed values for  $\sigma_{\parallel}$  and  $\sigma_{\perp}$ .

Stussl's formula was also tried for evaluation of the two parameters  $C_1$  and  $C_2$ . In view of the above formula involving two parameters as compared with Formula A, in which there is only one parameter, it was considered that in this case the calculated values would perhaps be closer to the observed values than in any other case. However, the values of  $C_1$  and  $C_2$  could not be easily evaluated as two identical equations involving  $C_1$  and  $C_2$  were obtained in evaluating the parameters either by the method of least squares or by taking any two observed values. Hence this formula was discarded.

With Formula C, the parameter  $P$  was determined for all angles taking the observed values of  $\sigma_{\theta}$ . The average value of  $P$  was then determined and substituted in Formula C for getting the calculated values of  $\sigma_{\theta}$ .

#### DISCUSSION

It may be noted that in solving the parameter  $n$  in Formula A, not only one approximation has to be made at one stage, but also two values are required to be observed (i.e.,  $\sigma_{\parallel}$  and  $\sigma_{\perp}$ ). In evaluating  $n$  for maximum crushing stress the various values of  $n$  at the different angles varied from -63.4 per cent. to +26.8 per cent. of its average value which worked out to be 2.05. In the case of crushing stress at E.L. the variation was from -23 per cent. to +75 per cent. of its average value which worked out to be 2.499. Also after obtaining the average value of  $n$  by the above method, the smooth curve of the calculated values does not necessarily pass through the fixed points and the value of  $n$  becomes ineffective for these points. Formula B appears to be more universal irrespective of species or condition of timber at test or the nature of stress applied. Formula C is the simplest of the three and required only one observed value for evaluation of its parameter  $P$ . Variation of  $P$  was from -18.1 per cent. to +38.5 per cent. of its average value (i.e., 7.02) in the case of maximum crushing stress and from -24.8 per cent. to +23.5 per cent. of its average value (i.e., 14.54) in the case of crushing stress at E.L. Also it was found from the graphs between observed and calculated values for crushing stress at E.L. and for maximum crushing stress (not reproduced here), the scatter as well as the slope of lines fitted by the method of least squares were the best in the case of Formula C. The sum of the squares of the difference between the observed values and calculated values is least in the case of Formula C than in the other two cases. It is to be hoped that Formula C being simplest, may find applicability with sufficient or even greater accuracy than the other two. However, further experiments are required to be done on other species and different types of stresses for a more conclusive evidence.

1. Brown, H. P., Panshin, A. J. and Forsaith, G. G., *Text-book of Wood Technology*, 1932, 2, 237, McGraw Hill.
2. Hansen, H. J., *Timber Engineers' Handbook*, 1948, John Wiley & Sons.
3. Kollmann, F., *Technologie des Holzes und der Holzwerkstoffe*, 1952, 1. Springer-Verlag, Berlin, Heidelberg, Göttingen.
4. Stussl, *Engineers' Digest*, 7 (3), 59.

# TENTH INTERNATIONAL CONGRESS OF MATHEMATICIANS\*

THE First International Congress of Mathematicians was held in Chicago 71 years ago and 25 mathematicians attended it. The Tenth Congress held at Amsterdam was attended by more than 2,000 ordinary and associate members. Forty-five countries including Russia participated in it; no Chinese delegate attended. The Congress represented a beautiful cross-section of the whole mathematical world, and showed how unity of purpose at a scientific level could get rid of all differences in caste, creed, colour and politics. Nineteen Indians registered themselves for the Congress, but only twelve attended. A number of them were already on the continent attending post-graduate courses. Prof. K. Chandrasekharan of the Tata Institute of Fundamental Research, Bombay, and Prof. B. R. Seth of the Indian Institute of Technology, Kharagpur, attended it as delegates of the Government of India.

In his Presidential Address, Prof. Shouten pointed out that there was hardly an activity in modern society which did not require the help of mathematics. A great responsibility had therefore come to rest on the shoulders of the mathematician. In the last two decades mathematics had played a great part in all technological advances and a large number of social and economic developments. In fact, as sciences grew to perfection they became mathematical. Thus had arisen the need for a large number of trained mathematicians in every branch of the subject.

In the afternoon Prof. J. von Neumann gave an address "On Some Unsolved Problems in Mathematics", a topic dealt with in a similar Congress by Hilbert in 1900. He discussed some problems of linear operation theory in non-compact spaces and ended with the suggestion that the logistic and probabilistic viewpoints may be brought together by developing them from the same set of axioms.

From September 3 to September 9, the Congress split itself into many sections and subsections, sometimes as many as twelve working simultaneously. The following represents a cross-section of what was actually presented at the meetings.

E. C. Titchmarsh gave an account of the work done on eigenfunction problems arising from differential equations of the type  $\Delta^2 \phi + [\lambda + f$

$(x, y)]\phi = 0$ . These problems arise out of Schrodinger's wave equation and have been extensively given by him in current journals. The classical method of residues is used and no general theory is employed.

Harishchandra gave an account of the work done of representation of semi-simple Lie groups. E. Stiefel showed how second order scalar procedure may be adopted in relaxation methods. He gave an account of the first order iteration method and discussed in detail the gradient method for error measure at each stage. Taking the linear equation in the matrix form  $Ax = k$  and assuming that  $A$  is symmetric and positive-definite he showed how the error measure may be determined at each state—a problem which has become important in view of the widespread use of relaxation methods. As a particular case he discussed the hypergeometric relaxation.

M. Reiner described the work of B. R. Seth on second order effects in elasticity. P. G. Bardoni derived some properties of finite strain invariants. A. Weinstein gave an account of axially elliptic and hyperbolic problems in which he and his co-workers have done much lot of work.

B. R. Seth read the papers of his co-workers S. D. Nigam and G. Bandyopadhyay on axis-symmetric and plane compressible flows. In Nigam's paper exact rotational solutions are obtained by transforming the equations such that the solution is made to depend on the linear equation  $(D^2 + k^2)\Psi = 0$ ,  $D^2$  being the Stokesian stream function operator. The solutions for spheroids are obtained in terms of wave cylinder functions and to the existing two boundary conditions another condition of no slip on the boundary is added to obtain the three arbitrary constants. In G. Bandyopadhyay's paper, conditions are investigated for deriving solutions of one-dimensional gas flows through an elastic tube from those for a corresponding rigid tube. The central assumption that the pressure is a function of the cross-section was open to criticism.

In another paper on "Synthetic Method for Compressible Flows", B. R. Seth indicated how the method, which has been used in a number of problems by his co-workers, H. G. Venkatesh, M. K. Jain and J. R. Foote in America, can be employed to investigate compressible

\* Held at Amsterdam, Sept. 1 to Sept. 9, 1954.



flow problems. The equations of continuity is reduced to the canonical form

$$\nabla^2 \phi_1 / \phi_1 = \nabla^2 \rho_1 / \rho_1, \quad \phi_1 = \rho_1^{\frac{1}{2}} \phi, \quad \rho_1 = \rho^{\frac{1}{2}}$$

and it is shown how some problems of uniform compressible flow may be solved. The possibility of using the method for discussing the formation of shocks was indicated.

J. J. Stoker showed how a perturbation technique for non-linear problems applied to shallow water waves gave a number of interesting results including that of the solitary wave.

B. Jessen of Denmark gave some results of the theory of almost periodic functions. He gave an account of Bohr's work and made out that any trigonometric polynomial of the form  $\sum a_n e^{i n t}$  possessed a mean motion. D. Gilbarg discussed methods in fluid dynamics with special reference to compressible flow. V. G. Szebehely showed that the classical formulation of the motion of a solid through an incompressible liquid was not suitable for free surface and impact problems. Starting with Bernoulli's equation he showed how a set of integral transformations gave the necessary results. A. R. Mitchell gave elementary solutions of shear flow through circular, elliptic and parabolic cylinders.

D. Van Danstzig gave an account of the mathematical problems raised by the floods of 1953, which affected about one-third of Holland. They were of three types—hydrodynamical, statistical and economic. Of these the last two were found to be of an elementary type. The hydrodynamical problems presented some interesting features. The area affected was idealized into an infinite medium of uniform depth internally bounded by a rectangle with three sides fixed. The reduced equations of motion were solved with the help of Laplace's transform.

K. Chandrashekharan spoke on localization and uniqueness theorems in Fourier analysis of more than one variable. He showed that results

obtained by analogy from one to higher dimensions need not always be correct. Thus arose the need of closely examining all extensions of one-dimensional Fourier series results to multi-dimensional analysis which is used in eigenfunction expansions of solutions of the wave equation. He pointed out a number of unsolved problems.

M. L. Cartwright dealt with non-linear vibrational equations of the type

$$\ddot{x} - k(1 + ax - x^2)\dot{x} + x = pk \cos lt$$

where  $k$  is small and  $a$  may be small or great. If  $a$  is small it is found that the results are unaffected, otherwise there is a marked difference.

S. Goldstein spoke on some methods of approximation in fluid dynamics. He pointed out that for higher approximations we should consider the fluid as a whole and not simply the boundary layer. He discussed the case of parabolic cylinder in detail and doubted if the irrotational and the boundary layer solutions could be patched together to give one solution. In this connection mention may be made of the synthetic method for flow problems which gives a continuous pattern for the whole fluid, including the boundary layer. This is being developed at the Indian Institute of Technology by B. R. Seth and his co-workers.

A large number of other papers on algebra, theory of numbers, analysis, geometry and topology, probability and statistics, mathematical physics and applied mathematics, logic and foundations, philosophy, history and education were also read.

On the closing day, September 9, A. N. Kolmogorov of Russia spoke on general theories of dynamical systems and classical mechanics. The Congress ended after deciding that the Eleventh Congress of Mathematicians be held in 1958 in Edinburgh in the month of August.

B. R. SETH.

## RECESSION OF STARS

**R**EPORTING on studies made on the recession of stars over the past 20 years, Dr. Allan R. Sandage, of the Mount Wilson and Mount Palomar Observatories, observes that the observations made by himself, Dr. M. L. Humason, of Mount Wilson and Mount Palomar, and Dr. N. N. Mayall, of the Lick Observatory of the University of California have gone as far as the Hydra Cluster, roughly 333 million parsecs. The speed of the recession is 180 kilo-

metres for each million parsecs, a parsec being 3.3 light years.

The Hydra Cluster was found to be receding from the earth at one-fifth the speed of light. This system is the farthest in space so far measured, but there is hope that existing equipment will make it possible to extend the measurements to objects receding at one-third the speed of light, or distances of 550 million parsecs.



## RECENT DEVELOPMENTS IN MOLECULAR SPECTROSCOPY\*

**R**ELIABLE determination of the molecular constants is of great importance for many applications as well as for progress in the theoretical understanding of molecular structure. In recent years increasingly accurate determinations of molecular constants of diatomic molecules are being made by microwave absorption spectra and by the more powerful spectrographs and improved techniques available now.

Because of the very high resolving power available in the microwave technique it has been possible to obtain with great accuracy the rotational constants of a large number of different types of poly-atomic molecules and also several diatomic molecules such as CO, ICl, etc. It has been also possible to study the hyperfine structure of rotational spectra, and to obtain nuclear spin, electric quadrupole moment and isotopic mass-ratios. Similarly in microwave and radio-frequency magnetic resonance spectra applied to molecular beams, transitions between the hyperfine structure components in a magnetic field give the nuclear magnetic moments. The electric analogue of the magnetic resonance method gives electric dipole moments, moments of inertia and quadrupole interactions. Similar methods are also employed with atomic beams. Other methods such as nuclear magnetic resonance, nuclear induction and nuclear quadrupole resonance have been applied to liquids and solids as well as for gases for the study of nuclear properties.

Much work remains, however, to be done in diatomic spectra with regard to molecules that have not yet been investigated and with regard to new electronic states of known molecules. A whole lot of spectra involving multiplicities greater than three awaits attention. In the vacuum ultra-

violet, Rydberg series for many diatomic molecules have yet to be studied.

In the case of polyatomic molecules, isotopes are useful for the species classification of frequencies. Particularly profitable has been the use of deuterium. It has twice the mass of hydrogen which it displaces and therefore gives rise to pronounced effects on the vibrational spectra of the molecules. So also, in the study of rotational levels using microwave spectroscopy, it becomes necessary, to use isotopic species of the molecule, because of the structural complexity of a polyatomic molecule. Now that elements enriched with any desired isotope are available from atomic piles, it is possible to increase the efficiency of the method of microwave spectroscopy, with its enormous resolution and dispersion. At present microwave spectroscopy offers the only method which can be employed for obtaining the spins, isotopic mass ratios, quadrupole moments and coupling constants, of the nuclei of radioactive elements of short life and low concentration which are important for nuclear physics.

Experimental investigation and theoretical development of the electronic spectra of polyatomic molecules are still in the exploratory stage. Because of the instability of an excited polyatomic molecule it has been very difficult to excite emission spectra. Nearly the same situation exists with regard to fluorescence spectra. It is only in a few cases that emission spectra have been observed. Emission in benzene derivatives excited by electron impact and in the positive column of a specially designed discharge tube in the presence of rare gases has been studied in recent years by Schuler and collaborators. The interpretation of the results is not yet very clear. Emission bands that correspond to the known absorption bands of the molecule have been obtained in benzene, toluene, aniline and several other organic aromatic molecules by Asundi and his co-workers.

\* Excerpts from the Presidential Address to the Physics Section of the Indian Science Congress, Baroda, 1955, by Professor R. K. Asundi.

## FLOWERING IN PLANTS\*

**T**WO environmental factors, light and temperature, have marked influence on the onset of reproductive phase in plants. Flowering in some plants may be hastened or delayed by presowing temperature treatment; in some

others, a minimum period of darkness and some light is required; there are also a few which are apparently independent of such requirements.

Under suitable conditions of light and/or darkness, some compounds are formed in the leaves which are transported to the growing points where floral primordia are formed. The stimulus is transmissible through graft partners

\* Abstract of Presidential Address to the Botany Section of the 42nd Session of the Indian Science Congress, J. C. Sen Gupta on "Control of Flower Initiation in Plants".

and is probably the same for plants of different flowering behaviour. The success claimed by various workers in extracting the active substance has not been reproduced.

There are at least three simpler processes concerned with the perception of the stimulus. There is a high intensity light process (requiring ca.  $6.6 \times 10^4$  of light energy) which must precede a dark period but can be bypassed by administering sugars or some Krebs cycle acids. With tracer carbon ( $C^{14}$ ) it has been shown that such compounds are synthesised in light and metabolised in darkness as the dark period becomes longer, supplying substrates for the ultimate synthesis of the "flowering hormone", if any. The dark reaction can be inhibited by a flash of light in the middle of the dark period; this is a low intensity light process probably not identical with photosynthesis. The pigment which perceives the stimulus is probably of phycocyanin type having absorption maximum at 6,600 Å convertible into an isomer absorbing maximum at 7,350 Å. The pigment is also present in lettuce seed, oat mesocotyls, etiolated pea internodes and tomato cuticle.

Low concentrations of auxin inhibit the flowering of short-day plants, while promoting that of some long-day plants; higher concentrations are inhibitory to both. It has been suggested that the auxin level in plants may be the controlling factor in floral initiation. For short-day plants a low auxin level appears to be conducive to reproduction. The possible factors which may reduce the auxin level are

the activities of naturally occurring inhibitors indolacetic acid oxidase, enzymes concerned with the synthesis of indoleacetic acid—the native auxin and X-radiations. Synthetic auxin-inhibitors like 2, 3, 5-triiodobenzoic acid, 2, 4-dichloranisole, etc., counter the inhibitory effect of auxins and promote flowering under non-inductive daylengths. There is good evidence, however, that the effect is indirect and auxins probably act by influencing the metabolic pathways concerned with the synthesis of the flower forming substance.

Recent investigations on  $CO_2$  fixation indicate that  $CO_2$  is essential during the dark inductive period for floral initiation in short-day plants. *Kalanchoe blossfeldiana*—a succulent—fixes  $CO_2$  vigorously in the dark as the induction treatment is prolonged but this  $CO_2$  is evolved as soon as the plants are subjected to light. Using  $C^{14}O_2$  it has been shown that the dark fixation pattern in short- and long-day plants is different, the rate of photosynthesis is influenced strongly and new compounds are formed in light photosynthetically and not photosynthetically. The rate of steady state photosynthesis in induced plants is increased to seven times that of the vegetative plants, and there are qualitative and quantitative differences in the products formed.  $C^{14}$  labelled compounds have been traced to the growing points.

The most promising line of study appears to be the isolation of the flower-forming substance or a synthetic compound capable of bringing vegetative plants into flowers.

#### RADIOACTIVITY OF THE HUMAN BEING

THE amount of radioactive substances deposited naturally in the normal human being has become one of the key figures in recent discussions on "tolerance" dose, "permissible" dose and "damaging" dose in repeated, as well as in single, total body exposures to ionizing radiations. Its magnitude, originally reported by Krebs as close to the accepted permissible body content of  $1 \times 10^{-7}$  g. radium element permanently fixed in the body, became uncertain, when Hursh and Gates in 1950 found values 100 to 1,000 times smaller than the accepted permissible content. While the reasons for this discrepancy were under discussion, Sievert in 1951, using a special gamma ray sensitive device for measurements on the intact living body as a whole, reported an average radioactivity of the human being close

to the values given by Krebs and thus close to the permissible content.

New data on this subject have been reported by Burch and Spiers and reviewed by Krebs in *Science* (1954, 120, 719). Krebs observes that in order to promote knowledge in the field, the following studies would seem to be necessary:

(i) Measurement of the radioactivity of many people as possible from different regions of the globe with the modern total-body activity measuring devices. (ii) Measurement of the kinds of radioactive substances in the body especially with regard to  $\alpha$ -emitting,  $\beta$ -emitting and/or  $\gamma$ -emitting elements. (iii) Detailed investigations of the radioactive materials incorporated daily by human beings from air, water and food.

## NUCLEAR SPECIES\*

THE study of the properties of various nuclides has been systematically pursued during recent years and a great many interesting results have been obtained. While most of these have been presented in papers and specialised review articles, a comprehensive elementary presentation of the whole field has been lacking. The timely appearance of Professor Huntley's lucidly written book will hence be welcomed widely.

Throughout the book, the need for viewing the entire collection of nuclides as a whole is stressed. The chart presenting nuclides with charge number against neutron number (Z-N diagram) is shown to be of basic significance much in the manner of the periodic system of elements to the chemist. The happy choice of descriptive phrases like "valley of stability", "northwestern slope", etc., would doubtless assist the beginner in retaining the mental picture of the Z-N diagram in relief. The usefulness of this method of presentation is elegantly brought out in the discussion of the stability of neighbouring isobars and of the connection between mass defects of neighbouring nuclides and their  $\beta^\pm$ , K activities. The deduction of the general properties of the "missing" element Z = 43 (technetium) is an interesting case.

The meaning of various concepts like "binding energy", "isomerism", etc., are clearly given; and illustrative numerical examples will give the student a feeling of the subject. The observed general properties of the nuclides are given in the form of empirical "rules", thirteen in all, five of them applying only to stable nuclei. While they are of value in giving a summary of the general characteristics, it is doubtful whether the student would be able to retain the "rules" as such. The reviewer feels that the excellent tabulations of

otherwise not easily obtainable data is of much greater value.

A trend to oversimplification is apparent in the theoretical arguments, the worst example being in the attempt to explain the saturation property of nuclear forces. This is perhaps responsible in part for certain omissions. For example, in talking of Bohr's model of the atom, the radical nature of the assumption of non-radiating accelerated orbits which is in direct contradiction with classical electromagnetism is not even mentioned; similarly, the necessity to invoke the quantum mechanical tunnel-effect to account for the finite lifetime of  $\alpha$ -decaying nuclei. But the omission of the  $\pi$ -meson, with its well-known 2-photon decay (when a hypothetical  $\nu$ -meson is postulated) from the list of elementary particles is inexplicable. The nuclear magnetic resonance technique of Bloch for the precision measurement of nuclear spins is also missing.

In the section on the origin of elements, the neutron capture theory is well presented, but rival theories are not even mentioned. A more substantial discussion of geo-chemistry and cosmo-chemistry would have been welcome. The tendency to one-sidedness is also evident concerning the "size" of the nucleus. The constant  $r_0$  in the relation  $r = r_0 A^{1/3}$  cm. from electron scattering by nuclei has been completely overlooked.

Apart from these defects, which can easily be remedied in the next edition, the book is a definite success. Intended for honours students of the British Universities, it is heartily recommended to the Second Year Honours student and the First Year Post-Graduate of the Indian Universities. The Post-Graduate student of Chemistry will also profit by reading the book; and the research worker beginning to specialise in experimental nuclear physics will find it an excellent elementary introduction.

E. C. GEORGE.

\* By H. E. Huntley. Macmillan & Co. Ltd., London, 1954. Pp. xix + 193. Price not given.

## WINDS AT HIGH ALTITUDE

TESTS have been carried out in Australia on the behaviour of winds up to a height of 65 miles, by a research team working under the direction of Professor Huxley of the Adelaide University.

Previous knowledge of upper atmosphere winds was confined mainly up to 40 miles. The present tests have shown that winds reach a

speed of 200 miles an hour at 62 miles height, and that they get faster in summer and slower in winter as altitude increases. They flow from east to west in summer and in the reverse direction in winter. Tidal winds have also been discovered which are caused by pulsations of the earth's atmosphere under the heat of the sun.

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THE NORMAL ELECTRON  
CONFIGURATIONS OF ATOMS

THE pattern of squares shown here, which can easily be constructed, will help one to write down quickly the ordinary electron configuration for any atom  $Z$ , in the normal state. The rows of squares taken horizontally represent the K, L, M, - - - shells of total quantum number  $n = 1, 2, 3, - - -$  respectively. The squares are designated 1 s; 2 s, 2 p; 3 s, 3 p, 3 d; etc., in the usual way.

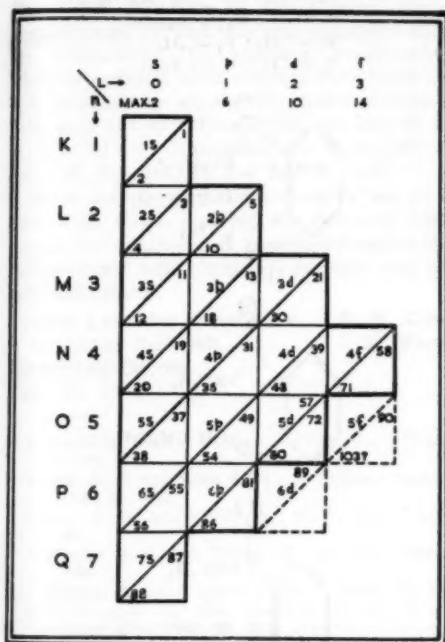
Diagonal lines are drawn as shown, starting from the left bottom corner of an 's' square and terminating at the farthest right top corner in each case. To get the sequence in which the shells and sub-shells are formed one has

to go down the diagonal lines from top to bottom starting with the first line, proceeding to the second, then to the third and so on.<sup>1</sup> Thus the sequence will be 1 s; 2 s; 2 p, 3 s; 3 p, 4 s; 3 d, 4 p, 5 s; 4 d, 5 p, 6 s; 4 f, 5 d, 6 p, 7 s.

Knowing that the maximum number of electrons in s, p, d, f shells are 2, 6, 10, 14 respectively, as indicated at the top of each column, the atomic number  $Z$  can be written in the serial order down each diagonal, as shown by the first and last numbers only in each square. Thus in the 4 d square 39 and 48 indicate that the first 4 d electron starts in element  $Z = 39$  and the 4 d shell gets completed with 4 d<sup>10</sup> in  $Z = 48$ . Exceptions to the general sequence can also be indicated, as for example 57 in the 5 d square which means that after 6 s<sup>2</sup> in  $Z = 54$



the 57th electron becomes a 5d, and the 4f starts with Z 58.



The trans-radium and the trans-uranium elements can be included by adding the 5f and the 6d squares to the pattern. These are shown by the dotted lines.

Mahakoshal Mahavidyalaya, A. S. GANESAN.  
Mabapur, September 30, 1954.

1. Therald Moeller, *Inorganic Chemistry*, 1952 (John Wiley), 97.

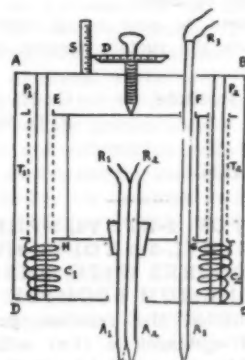
### MEASUREMENT OF SURFACE TENSION

A COMPACT and accurate instrument for the measurement of surface tension of liquids has been devised by the authors. It is based on the maximum bubble pressure method. ABCD is the main box in which the frame EFGH moves up and down by moving the graduated drum D. The motion of EFGH is guided by the rods P<sub>1</sub>, P<sub>2</sub>. The tubes T<sub>1</sub> and T<sub>2</sub> attached to EFGH fit the rods exactly. The springs C<sub>1</sub>, C<sub>2</sub> help the motion of the frame when the drum is moved upwards.

A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub> are three hollow glass tubes with drawn ends. The tube A<sub>3</sub> is fixed in position

while A<sub>1</sub>, A<sub>2</sub> move with the frame EFGH. The tubes are joined to a source of compressed air by the rubber tubes R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>. The tubes A<sub>1</sub>, A<sub>2</sub> carry stop cocks so that they can be opened at will.

The tubes are immersed in a beaker of liquid whose surface tension is required. In the beginning, A<sub>1</sub> is open and A<sub>2</sub> closed. The bubbles will come out either from A<sub>1</sub> or A<sub>3</sub>. The drum D is then moved until the bubbles come out simultaneously from A<sub>1</sub> and A<sub>3</sub>, and the reading on the drum noted. A<sub>1</sub> is then closed and A<sub>2</sub> opened, and the drum is again adjusted until the bubbles come out simultaneously from the two. This reading on the drum is also noted.



The maximum pressure of the bubble is given by

$$P_{\max} = gd\rho + 2\gamma/r$$

where  $d$  is the depth of the tube in the liquid,  $\rho$  the density of the liquid,  $\gamma$  the surface tension and  $r$  the radius of the bore of the tube.

When the bubbles come out simultaneously from A<sub>1</sub> and A<sub>3</sub>, we write

$$gd_1\rho + \frac{2\gamma}{r_1} = gd_3\rho + \frac{2\gamma}{r_3} \quad (1)$$

Similarly for A<sub>2</sub> and A<sub>3</sub>, we have

$$gd_2\rho + \frac{2\gamma}{r_2} = gd_3\rho + \frac{2\gamma}{r_3} \quad (2)$$

From (1) and (2) we get

$$gd_1\rho - gd_2\rho = 2\gamma \left( \frac{1}{r_2} - \frac{1}{r_1} \right)$$

or

$$\gamma = \frac{gd_1\rho - gd_2\rho}{2 \left( \frac{1}{r_2} - \frac{1}{r_1} \right)} = K \cdot \rho \cdot (d_1 - d_2)$$

where  $K$  is the constant of the instrument.

Typical results for benzene are given below.



K (as determined from observations on water) = 44.59;  $\rho = 0.8675$  gm./c.c.; temperature = 30°C.

$d_1 - d_2$ cm.	$\gamma$ dynes/cm.
0.7115	27.53
0.7095	27.45
0.7095	27.45
0.7100	27.48
0.7115	27.53
0.7125	27.57
Mean	27.50

This may be compared with the accepted value 27.56 for benzene.

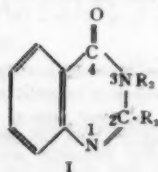
The instrument is now being used by the authors to study the surface tension of certain solutions.

M. G. Science Institute,  
Navarangpura,  
Ahmedabad-9,  
November 18, 1954.

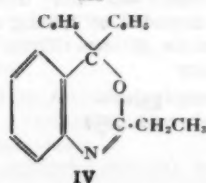
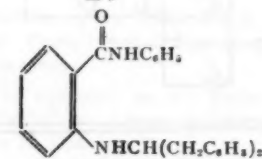
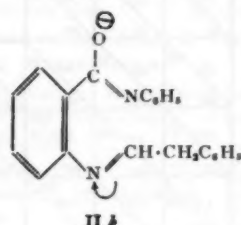
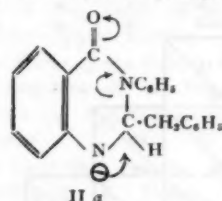
G. M. SHAH.  
P. D. PATHAK.

#### REACTION OF 2-ETHYL-3-PHENYL- AND 2-ETHYL-3-*p*-TOLYL-4(3H)- QUINAZOLONES WITH PHENYL- MAGNESIUM BROMIDE

KOELSCH<sup>1</sup> identified the reaction product of 3-phenyl-4(3H)-quinazolinone (Ia) with benzylmagnesium chloride as N-( $\beta$ ,  $\beta'$ -diphenylisopropyl)-anthranililide (III). He explained the course of reaction by postulating that an electrophilic centre is developed at C-2 of Ia under the conditions of the reaction, whereby, R of  $R^-MgX^+$  attacks at this carbon atom to form the intermediate (IIa). This intermediate through a more stable form (IIb) yields III by the addition of another molecule of the Grignard reagent at the aldimine linkage of IIb. Sen and Sidhu<sup>2</sup> and Sen and Upadhyaya<sup>3</sup> reported the formation of 3, 4-dihydro-2, 3, 4-trisubstituted-quinazolinol (named as 4-quinazolols by the authors) when Ib, Ic, or Id was reacted with phenyl-, *n*-propyl-, or *n*-butylmagnesium halide. The course of reaction was attributed to the normal reaction at the  $>C=O$  grouping at C-4 of the quinazolinone.



- (a)  $R_1 = H$ ;  $R_2 = C_6H_5$   
 (b)  $R_1 = CH_3$ ;  $R_2 = C_6H_5$   
 (c)  $R_1 = CH_3$ ;  $R_2 = CH_2CH_2CH_2CH_3$   
 (d)  $R_1 = CH_3$ ;  $R_2 = \alpha$ -naphthyl  
 (e)  $R_1 = C_2H_5$ ;  $R_2 = C_6H_5$   
 (f)  $R_1 = C_2H_5$ ;  $R_2 = p$ -Tolyl



In our experiments, when 2-ethyl-3-phenyl or 2-ethyl-3-*p*-tolyl-4(3H)-quinazolinone<sup>4</sup> (I<sub>a</sub>, I<sub>f</sub>) was reacted with phenylmagnesium bromide, the main product of the reaction in each case was the same colourless crystalline solid, m.p. 154-55°, yielding identical picrates, m.p. 186-87° and picrolonates, m.p. 177-78° (decomp.). Besides this product, aniline or *p*-toluidine (identified through their acetyl derivatives) was also isolated from the Grignard reaction mixture, depending on the substituent at C-3 of the starting quinazolinone.

The solid (m.p. 154-55°) could not be acetylated and gave a negative Liebermann nitroso reaction. When hydrolysed with 15 per cent hydrochloric acid, it gave the following identifiable products: 2-aminophenyldiphenylcarbi-

nol,<sup>5</sup> m.p. 121-22° (identified through its N-acetyl derivative,<sup>6</sup> and also by admixture with an authentic sample), benzophenone and aniline. The structure of the product therefore seemed to be IV and this was confirmed through its preparation by reacting 2-aminophenyl-diphenylcarbinol with n-propionic anhydride in the presence or absence of fused sodium acetate, m.p. 154-55° (Found Mol. wt. 315; C, 84.4; H, 6.2; N, 4.7. Calculated for  $C_{22}H_{19}ON$ : Mol. wt. 313; C, 84.4; H, 6.1 and N, 4.5).

Since the abovementioned results are in conflict with those reported by Sen and Upadhyaya,<sup>3</sup> the reactions of 2-methyl-3-aryl-4(3H)-quinazolones with Grignard reagents are under reinvestigation.

Central Labs. for Scientific & S. H. ZAHEER.  
Industrial Research, I. K. KACKER.  
Hyderabad-Deccan,  
July 12, 1954.

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#### CONSTITUTION OF LANCEOLATIN C AND LANCEOLATIN B

FROM the root bark of *Tephrosia lanceolata* Grab., three crystalline substances were isolated by Rangaswami and Sastry and designated lanceolatin A, lanceolatin B and lanceolatin C.<sup>1,2</sup> Studies on the constitution of the two latter compounds have been completed now. The salient results are given below:

Alkaline fission of lanceolatin C under varied conditions yielded benzoic acid, o-methylkaranjic acid and acetophenone (isolated as the 2:4-dinitrophenylhydrazone). Benzoic acid was formed also by treatment with neutral potassium permanganate. The formation of these three substances and other properties of lanceolatin C lead to the structure o-methylkaranjoylbenzoylmethane for this substance. The same structure has recently been deduced for pongamol, a compound obtained from the oil of *Pongamia glabra*.<sup>3,4</sup> This fact and the fact that the reported m.p.'s of pongamol and lanceolatin C are very close or almost the same suggested their probable identity. The

mixed m.p. was therefore determined and it was found to be undepressed, thus substantiating the conclusion reached on other grounds.

Lanceolatin B also yielded benzoic acid and acetophenone by alkaline degradation, but in place of o-methylkaranjic acid obtained from lanceolatin C, lanceolatin B yielded karanjic acid. Two more products were also obtained and characterised as 4-hydroxy-5-acetylcoumarone and karanjoylbenzoylmethane. These fission products, taken together with the insolubility of lanceolatin B in alkali and its recovery without change under conditions of acetylation and methylation, lead to the structure 7:8 (2':3')-furanoflavone for this compound. Corroboratory evidence for this conclusion was furnished by the formation of lanceolatin B when lanceolatin C was subjected to demethylation by treatment with hydrogen bromide in glacial acetic acid.

The analyses recorded for lanceolatins B and C in the earlier publications<sup>1,2</sup> and augmented later on are compatible with the structures deduced above, but the molecular formulae suggested earlier in analogy with well-known rotenoids become obsolete in the light of the present findings.

Dept. of Pharmacy, S. RANGASWAMI.  
Andhra University, B. V. RAMA SASTRY.  
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#### ACTION OF FOSSIL WOOD ON PHOTOGRAPHIC PLATE

PREVIOUS investigations by the author<sup>1</sup> have shown that Indian woods possess the property of reacting on a photographic emulsion and imprinting thereon its image. The study has since been extended to fossil woods. The fossil wood used for this experiment belonged to the Upper Cretaceous period, and was lent by the Department of Geology, Presidency College, Madras. Its age is estimated to be near about 90 million years.

The specimen was placed in contact with the sensitised surface of a photographic plate in darkness and allowed to remain on it for a period of 48 hours. On processing the plate in the usual way, a clear image of the fossil was found imprinted on the emulsion.



FIG. 1

Fig. 1 represents an actual photograph of the fossil taken with a camera, and Fig. 2 the picture recorded by it in darkness on the photographic plate.

It is common knowledge that some fossils exhibit traces of radio-activity. In order to ascertain whether the observed phenomenon was a case of true Russel Effect, extremely thin sheets of mica, and cellophane paper were interposed between the photographic plate and the specimen, when there was no trace of any action in the regions covered by the paper. However, the effect persisted when the plate and specimen are separated by a small distance and also when a sheet of filter paper is interposed between them. It seems certain that radio-activity is not therefore the cause for this action. Further, the fossil had no action on panchromatic plates, like the H.P.S. and H.P. 3, which is similar to the behaviour of ordinary woods in Russel effect. However, fossil wood seems to differ from ordinary wood in that it does not exhibit a marked increase in activity after irradiation by sunlight.

The author's thanks are due to the Government of India for sanctioning a grant to conduct this investigation.

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November 19, 1954.

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FIG. 2

#### PHYLLOTRETA CHOTANICA DUVIVIER, A NEW PEST OF MUSTARD IN WEST BENGAL

*Phyllotreta chotanica* Duviv., has been noted for the first time as a pest of mustard in West Bengal. An outbreak of this pest was observed last year at Mathurapur, under district 24 Parganas, West Bengal.

The genus *Phyllotreta*, belonging to the family Halticidae, comprises a large number of destructive species enjoying a worldwide distribution and most of them are notorious pests of the Cruciferous plants.

The species *Chotanica* was first described by Duvivier<sup>1</sup> in 1892 from Bengal. Shroff<sup>2</sup> recorded it as a minor pest of mustard, cabbage, cauliflower and radish from Burma. In India it was noted in small numbers on cabbage and Pusa (Fletcher<sup>3</sup>). There seems to be no other record of the species as a pest.

The beetle is small and oblong, measuring about 2 mm. in length, the colour of the upper side being metallic bronze with bluish reflections. The interantennal ridge sharply elevated, vertex without punctures. Antennae black, extending a little beyond the middle of the elytra. Prothorax broader than long, closely covered with punctures, scutellum small and triangular. Elytra closely covered with punctures and the posterior part of the surface without ribs.

The beetles attacked mustard in the late stage of development of the crop, making small holes in the leaves and fruits. No control measure was adopted against the pest in order to study the extent of damage, which was found to be severe. The affected plants gradually dried up and consequently the yield was negligible.

Thanks are due to the Commonwealth Institute of Entomology, for kindly identifying the insect and to Miss Gopa Konar, for drawing the sketch.

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ADYANATH BASU.

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August 30, 1954.

Thanks are due to the Commonwealth Institute of Entomology for kindly identifying the specimen.

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Calcutta-40, September 21, 1954.

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#### APANTELES PHYTOMETRAE WILKINSON, A NEW LARVAL PARASITE OF SUGARCANE STEM BORER

WHILE searching for a suitable parasite for the control of sugarcane borers, the authors recorded this insect as a new addition to the list of parasites so far published. In August, 1953, *Apanteles phytometrae* Wilkinson, was noted to parasitise the larvae of the sugarcane stem borer, *Chilotræa infuscatellus* S., at the Seed Multiplication Farm, Burdwan.

The genus *Apanteles* comprises a large number of species many of which have been recorded as parasites of various crop pests. *A. flavipes* Cam. has already been established as a parasite of different sugarcane borers in the Punjab, U.P., Behar and Madras.

The species *Phytometrae* was first described by Wilkinson in 1928 and it derives its name from two noctuid moths, *Phytometra chalcites* Esp., and *Phytometra signata* F., on which it was bred by Buxton (Wilkinson<sup>1</sup>).

The parasites are black in colour. Palpi, the 4 anterior legs (except their coxae and trochanters), basal half of the hind tibiae, basal joint of the hind tarsi at extreme base, basal ventrites, lateral membranous margins of the first and second tergites, lightly reddish testaceous; hind femora, apical half of hind tibiae, remainder of hind tarsi, tegulae, antennae, stigma, metacarp-dark red brown. Mesonotum sparsely and finely punctate (degree 2), propodeum largely smooth basally. First tergite indefinitely sculptured in the apical fourth. The lateral bounding sulci of the second tergite are straight.

The insect is an ectoparasite and cocoons were formed on the dead larvae.

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#### EFFECT OF LUCERNE SUPPLEMENT TO THE RICE DIET ON THE BODY COMPOSITION OF GROWING RATS

IN an earlier communication<sup>1</sup> it was reported that the rate of growth of rats receiving the poor rice diet is nearly trebled on incorporating 4 per cent. (on dry weight) of lucerne leaf-flour. Considering the amount of supplement fed, the increase in growth rate was remarkable. Growth rate as usually measured by increase in weight is not, however, adequate indication of well proportioned body growth. It was of interest therefore to measure the 'chemical growth' of the animals in order to corroborate the earlier results on measurements by 'physical growth'.

Two groups of freshly weaned rats (3 males and 3 females in each group) were fed *ad libitum* for a period of eight weeks on, (i) the poor South Indian rice diet, and (ii) the same diet in which rice was replaced to the extent of 4 per cent. by an equivalent amount of lucerne (*Medicago sativa* Linn.) leaf-flour. At the end of the experimental period, the animals were anaesthetized and the alimentary canal emptied of residual food and faecal contents. The carcasses were weighed to obtain the 'net body weight', minced twice in a meat mincer and stored under alcohol in separate bottles. The minced carcasses were subsequently refluxed twice with alcohol, once with alcohol-ether mixture and then with ether alone. The pooled extracts were collected and freed of solvent. For obtaining the total body lipids, the fatty residue was redissolved in petroleum ether, filtered, evaporated, dried and weighed. The residue insoluble in petroleum ether was added to the solvent extracted carcass, dried at 95-100° C. and weighed as non-lipid solids. Nitrogen (macro-Kjeldahl method), ash and calcium in the non-lipid solids were determined by the usual methods.

The absolute values for each of the body constituents were very much higher in the animals receiving lucerne than in the control



group. For purposes of comparison, the values were calculated as per 100 g. net body weight and are presented in Table I.

TABLE I

Effect of lucerne supplement on the body composition of growing rats

(Figures represent average of six values)

	GROUP I (poor rice diet)	GROUP II (poor rice diet + 4% Lucerne)	Significance
Body weight (g.)	79.3 ± 2.85	126.2 ± 8.05	..
Body water (%)	68.5 ± 0.74	64.4 ± 1.05	†
Body solids (%)	31.5 ± 0.74	35.6 ± 1.05	†
Body lipids* (%)	8.7 ± 0.48	12.7 ± 0.82	†
Non-lipid solids (%)	22.8 ± 0.52	22.9 ± 0.59	n.s.
Body ash (%)	3.25 ± 0.050	2.79 ± 0.088	†
Body calcium (mg. %)	614 ± 20.2	759 ± 23.7	†
Protein (N × 6.25) (%)	16.1 ± 0.49	15.9 ± 0.65	n.s.
Carbohydrate (by difference) (%)	4.4 ± 0.48	4.2 ± 0.57	n.s.

\* Petroleum ether extractives; † Significant at 1% level; n.s. Not significant at 5% level.

It is of interest to note that, as compared with the animals in the control group, those receiving lucerne supplements not only grew at a much faster rate, but also contained significantly greater percentage of total body solids. The higher proportion of total body solids was principally due to an increase in body lipids (petroleum ether extractives). That the content of body lipids was higher in Group II even though there was no difference in the fat levels of the two diets, shows greater storage of body lipids in animals receiving lucerne supplements. Further work requires to be done for elucidating the significance of this observation. Increase in body ash, though small, was significant. The proportions of body protein and non-lipid solids were the same in both the groups.

It is well known that body calcium increases with maturity in growing rats.<sup>2</sup> In separate experiments we have observed that freshly weaned animals contained 0.70 per cent. body calcium. It would thus appear that the body calcium of animals receiving the poor rice diet decreased to 0.61 per cent. by the end of the experimental period. Although the animals receiving lucerne supplements grew at a much faster rate, their body calcium increased to 0.76

per cent. showing thereby better calcification of the bones of growing rats.

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September 13, 1954.

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## OCCURRENCE OF CHARACIOSIPHON RIVULARIS IYENG.

THERE have been two reports<sup>1,4</sup> on the occurrence of *Characiosiphon* since Iyengar<sup>3</sup> first discovered and described it from Trichinopoly. During the author's collection of Jodhpur algae,<sup>3</sup> this variety was found growing in two different habitats in places near about Jodhpur. In August 1951, it was found growing in small clusters on tiny stones, pebbles, decaying twigs, snails and other submerged substrata (not uncommonly even epiphytically) in the Umed Bund—a permanent stretch of standing water. Since in all the previous reports it was found growing in flowing water, the present is a record of a new type of habitat for this alga. In Umed Bund the alga was not growing in equal profusion on all sides of the Bund. Growth was more profuse towards the rocky windward side of the Bund where water-level rises and falls with some force. Towards the side of the Bund, it was less common. However in August 1952, I found this alga near Motikund (Jodhpur). Here it was growing in a temporary stream, a few inches deep, starting from Motikund and ending in Sursagar Tank—a habitat which has been reported previously. In Umed Bund the alga remains only for 20-25 days in the month of August, immediately after rains have set in, but in flowing water it remains longer.

Like the Tirupati material, the well developed thalli of Jodhpur alga are also slightly longer than those described by Iyengar and Agarkar, measuring between 1.3 cm. to 1.5 cm. but in breadth they are like the Gwalior material measuring between 2-3 mm. when mature. Lobed thalli were found to be absent in the Jodhpur material.

In addition to the abovementioned records of this alga, Dr. Dass Gupta of Lucknow has collected it from near Almora. Dr. T. S. Mahabale informs me that he and his students have collected it from Borivli (Bombay).\*

I am thankful to Dr. M. O. P. Iyengar for his helpful correspondence and Prof. B. V.



Ratnam for his valuable suggestions and help in preparing this note.

Botany Dept.,  
Jaswant College, Jodhpur,  
July 1, 1954.

M. M. BHANDARI.

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\* Since this note was sent for publication, the alga has also been collected from still another place in the vicinity of Jodhpur: the Lalsagar—a permanent stretch of standing water. The peculiarity about the alga from here is that the thalli were comparatively bigger and many of them became spherical or globular. Moreover, the labation of the thalli reported by Agarkar has also been found to occur in the Lalsagar material.

### CHROMOSOME NUMBERS IN INDIAN DESERT PLANTS

WHILE studying the characteristic behaviour of the desert plants, a preliminary study on the cytological aspect was undertaken. The present paper deals with the chromosome numbers of the following plants found in the vicinity of Pilani. A perusal of the literature<sup>1</sup> reveals that no report has been made of the chromosome numbers in these plants so far. The somatic as well as meiotic numbers have been determined from sections and squashes of actively growing root tips and flowerbuds respectively. The chromosome counts are based on maximum numbers counted from intact cells. As recorded in earlier communications,<sup>2,3</sup> the counts show prevalence of polyploidy and regularity in the chromosomes of Angiosperms.

Plant	Chromosome No.		Basic number of the genus	Uses
	n	2n		
<i>Crotalaria burjia</i> Hamilt.	8	16	(8)	Textile fibre
<i>Tephrosia purpurea</i> var. <i>pumila</i> Pers.	12	..	(6, 7, 8)	Dye and green manure
<i>Tephrosia purpurea</i> var. <i>maxima</i> Pers.	12	..	(6, 7, 8)	Dye and green manure
<i>Indigofera trigonoloides</i> Jaub & Spach.	8	16	(8)	Sand binder
<i>Indigofera cordifolia</i> Heyne	8	16	(8)	Sand binder and medicinal value
<i>Indigofera argentea</i> Linn.	8	16	(8)	Sand binder
<i>Indigofera ennea-phylla</i> Linn.	..	16	(8)	Sand binder and Green manure
<i>Indigofera retroflexa</i> ?	..	16	(8)	Green manure
<i>Cassia sophora</i> var. <i>purpurea</i> Linn.	12	24	(6, 7, 8)	Horticultural plant

Other desert plants are also being examined from the view-point of chromosome number and morphology. Further studies on the morphology of the different species are in progress and will be published elsewhere.

I am thankful to Dr. B. N. Mulay for kind help during the investigation.

Cytogenetics Lab.,  
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September 11, 1954.

K. RAMANATHAN.

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### MORPHOLOGY OF THE SKULL OF *EUTROPIICHTHYS VACHA*

THERE is not much literature available on the morphology of the skull of Indian siluroid fishes. The pioneer work in the field is that of Bhimachar<sup>1</sup> who worked out the cranial morphology of eight Indian catfishes. The observations on the skull of *Eutropiichthys vacha* have been based on the study of clean and thoroughly bleached skulls.

In the pre-cretaceous bony fishes, Woodward<sup>2</sup> found the posterior cranial region to be flat and also no definite cranial boundary was observed by him. Bhimachar,<sup>1</sup> working on the Indian siluroids, viz., *Wallago* and *Silundia* also observed a flat nature of the hinder region of the skull and associated this condition with primitiveness. On the other hand, in the case of *Eutropiichthys vacha* the occipital region is much ridged and perforated. There is a marked slope visible from the occipital region to the ethmoid region. The supra-occipital spine has also been found to be prominently ridged. The advanced condition of the skull is again evident when the firm articulation of complex anterior vertebra with the skull is taken into consideration. Moreover, the occipital region of the skull is connected by a massive H-shaped post temporal. The basioccipitals are also firmly fused. These skeletal characters take *Eutropiichthys* to a much higher position in the family Siluroidae.

In addition to the above, there are certain other cranial features of *Eutropiichthys vacha* which can be traced to the feeding habits of the fish. The thin papery and porous condition of the cranial bones is one outstanding peculiarity associated with such mode of life. If we compare the skull of a sedentary bottom feeding fish like *Clarias batrachus* with that

of *Eutropiichthys vacha*, it is found that the characteristic cephalic shield of the former is entirely absent in the latter, where it would be a sort of hindrance to the attainment of speed. It will not be out of place to mention that the agility of *Eutropiichthys vacha* is further increased due to the porous nature of the upper cranial surface and the thin-ridged occipital region which lightens the weight of the head and thus adds to the buoyancy of the fish. In confirmation of this view it may be noted that parasphenoid has been found to be ill-developed in surface feeding siluroids like *Eutropiichthys* than in the sedentary ones like *Clarias batrachus* and *Saccobranchius fossilis*. The lateral shifted orbits of *Eutropiichthys vacha* can also be correlated with the feeding habit of this fish.

The predaceous nature of the fish has also been responsible for the adaptation of certain characters. In siluroids, usually the premaxilla, dentary and vomer bones are toothed while the maxilla is much reduced and edentulous. But in *Eutropiichthys vacha*, the maxilla is firmly studded with minute conical teeth. This additional dentition is obviously of great help to the fish.

According to Kingsley<sup>2</sup> only one pterygoid bone is found in Siluroids but here an additional metrapterygoid has been observed and unlike the ectopterygoid of *Clarias batrachus* it is very much toothed. The articular bone has also been found to be provided with small teeth on its surface.

The skull of *Eutropiichthys vacha* thus clearly shows both advanced characters as well as the characters which the fish has adapted for its mode of life.

The author's grateful thanks are due to Dr. D. R. Bhattacharya for his kind interest in the problem and to Dr. S. K. Dutta for the encouragement and guidance.

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Allahabad, September 27, 1954.

ANJNI KUMAR.

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#### PHYLOGENETIC STUDY OF THE FAMILY CHRYSOMELIDÆ COLEOPTERA

MALE and female genital conduits of 90 species representing thirteen subfamilies of Chrysomelidæ known to occur in India were

studied by the author while determining the inter-subfamily relationship.

Taking subfamily Orsodacninae as the most primitive (Sharp and Muir<sup>1</sup>), the subfamily Donaciinae follows Orsodacninae closely by virtue of strongly keeled cap piece and completely ringed character of tegmen in the male genital tube. The subfamilies Sagrinae and Criocerinae are closely related for reasons such as, strongly keeled and partially ringed character of tegmen in male genital tube, and closely attached paraproct—proctiger and valvifer—coxite condition in female genitalia. These characters being common to the subfamily Donaciinae save partially ringed condition of tegmen, a positive relationship between this subfamily and the former two can be assumed.

The subfamilies Clytrinae and Cryptocephalinae are closely associated; characters common to both are—short and stout median lobe, broad and long median foramen, internal sac with typical elongated chitinated sclerites, and compact spiculum gastrale with stout arms in male genital tube while in female genitalia dorso-lateral position of proctiger which joins with coxite through a valvifer. Absence of sclerotized rod in coxite are common.

These two subfamilies show marked affinity with the preceding subfamilies in respect to keeled condition of tegmen in the male genital tube. The short and stout median lobe in male genital tube and bilobed appearance of coxite in female genitalia links the subfamily Chlamydinae with the subfamilies Clytrinae and Cryptocephalinae. The subfamilies Lamprosominae and Eumolpinae exhibit close relationship due to the presence of shield like tegmen, long median foramen, sometimes half of median lobe in male genital tube and telescopic condition of female genitalia. The latter subfamily also maintains relationship with the subfamily Galerucinae. The common characters in the female genitalia are: long forked appearance of valvifer and presence of long thin sclerotized rod supporting the coxite. The subfamilies Galerucinae and Alticinae are very closely related due to the presence of tube-like median lobe, modified rod like Y- or V-shaped tegmen in male genital tube and loose attachment of valvifer with coxite in female genitalia.

Marked affinity between Cassidinae and Hispinæ is established by the presence of partially ringed and keeled condition of tegmen, elbowed appearance of median lobe at the junction of median foramen in male genital tube and close attachment between proctiger-coxite and

TABLE I

Table giving salient characters of genitalia in the different subfamilies of Chrysomelidae

Name of Subfamily	Characters of genitalia	
	Male	Female
Donaciinae	.. Tegmen completely ringed, round median lobe and cap piece strongly keeled	Valvifer-coxite closely attached
Sagrinae and Criocerinae	.. Tegmen partially ringed, round median lobe and cap piece strongly keeled	Paraproct-proctiger and valvifer-coxite closely attached
Clytrinae and Cryptocephalinae	.. Median lobe short, stout, median foramen long, internal sac with typical elongated chitinated sclerites and spiculum gastrale compact with stout arms	Proctiger dorso-laterally placed and joined with coxite through valvifer, sclerotized rod in coxite wanting
Chlamydinae	.. Median lobe short and stout	Coxite bilobed
Lamprosominae and Eumolpinae	.. Tegmen shield like, median foramen long sometimes half of median lobe	Female genital segments telescoped within each other
Chrysomelinae	.. Tegmen mildly keeled, arms incompletely embracing median lobe	Proctiger-coxite closely connected valvifer wanting
Galerucinae and Alticinae	.. Median lobe tube like, tegmen modified into Y-or V-shaped, rod like structures	Valvifer-coxite loosely attached
Cassidinae and Hispinae	.. Tegmen partially ringed round median lobe and keeled, median lobe elbowed.	Proctiger-coxite closely attached, valvifer wanting

absence of valvifer in female genitalia. None of the characters either in the subfamily Hispinae or Cassidinae are common to Eumolpinae as stated by Powell.<sup>2</sup> Their affinity with the subfamily Chrysomelinae is more conspicuous by similarity of characters like tegmen being mildly keeled and arms incompletely embracing the median lobe in male genital tube and close connection between proctiger-coxite and absence of valvifer in female genitalia. Through the subfamily Chrysomelinae subfamilies Hispinae and Cassidinae may also be related to subfamilies Clytrinae and Cryptocephalinae on the basis of keeled condition of tegmen in the male genital tube.

As a result of this study, it can be concluded that the subfamilies Donaciinae, Sagrinae and Criocerinae are the most primitive, followed by Clytrinae and Cryptocephalinae, while Galerucinae and Alticinae are more recently evolved.

Thanks are due to Dr. K. B. Lal, under whose personal guidance the work was carried out, and to Indian Council of Agricultural Research for the award of Fellowship.

Lab. of the Entomologist B. K. VARMA.  
to Govt. of U.P.,  
Kanpur, July 31, 1954.

#### EFFECT OF IRON ON HEADING OF WHEAT

EXPERIMENTS were conducted during 1950-53 to study the effect of iron on the heading of wheat (Pb 591). The interval for initial presence and absence of iron was kept for 40 days with a total life-cycle of 120 days in the first year, but in the second and third years the interval was made 20 days with a total life-cycle of 100 days and 120 days respectively. Plants were cultured in pyrex containers supplying nutrients following Knop's<sup>3</sup> modified schedule except for the quantity of iron (Ferric tartrate) which was supplied according to the plan of the experiments. Table I indicates the time interval from planting to heading stage.

The results from Table I show that the plants receiving no iron did not bear heads because of their premature death. On an average it took 4-5 days from 'A' to 'E' stage. Appearance of heads late in 1950-51 is explained by the fact that the experiment was started much earlier in the season which increased the life-cycle of plants. It was noticed that the presence of iron upto the first 40 days did not produce ears and if this period was extended to 60 days and onwards emergence was hastened by 3-5 days, but this was true upto 80 days only, after which it had, if at all, very little

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TABLE I  
Effect of initial supply of iron followed by its absence on heading in wheat

Initial supply of iron in days	1950-51				1951-52				1952-53			
	Fe <sub>1</sub>		Fe <sub>2</sub>		Fe <sub>1/2</sub>		Fe <sub>1</sub>		Fe <sub>1/4</sub>		Fe <sub>1/2</sub>	
	Age in days		Age in days		Age in days		Age in days		Age in days		Age in days	
	A	E	A	E	A	E	A	E	A	E	A	E
0	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
20	..	..	..	..	NE	NE	NE	NE	NE	NE	NE	NE
40	NE*	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
60	..	..	..	..	85.75	91.25	87.25	93.35	88.35	93.75	88.38	93.69
80	102.12	107.75	103.37	107.12	83.75	88.95	83.34	88.62	84.32	88.43	84.47	89.13
100	..	..	..	..	82.75	87.75	83.20	87.81	83.65	87.96	84.21	88.92
120	100.85	105.12	101.55	106.12	..	..	..	..	83.65	87.96	84.21	88.93

\* NE = No Emergence.

Fe<sub>1</sub> = 12.91, Fe<sub>2</sub> = 25.82, Fe<sub>1/2</sub> = 6.45, Fe<sub>1/4</sub> = 3.22—in p.p.m.

effect. This may be explained by the fact that the emergence took place just after 80 days. Thus it is indicated that the presence of iron between 40 and 80 days and especially between 60 and 80 days was essential. This fact was emphasised by Gericke<sup>2</sup> working on wheat who showed that if the iron supply was stopped after 6 weeks plants died of premature death and if it was withheld after 8-10 weeks it resulted in inhibited grain production. It is further indicated that the concentrations higher than Fe<sub>1</sub> (3.22 p.p.m.) had no better effect. Aiyer<sup>1</sup> working on rice has stressed that the quantity of iron required each time by rice plants is too small, and a concentration lower than 2.0 p.p.m. showed symptoms of deficiency.

It was also observed that the initial deprivation of iron for the first 40 days delayed the emergence by 2 days and increasing the deprivation beyond 60 days plants did not bear heads.

The author is indebted to Dr. N. K. Anant Rao, for his valuable guidance and suggestions.

Agronomy Section,  
B. R. College, Agra,  
September 17, 1954.

R. M. SINGH.

#### A BACTERIAL LEAF-SPOT DISEASE OF *LOCHNERA PUSILLA*

*Lochnera pusilla* K. Schum., a common weed in the cultivated fields was found to be heavily infected with a bacterial disease in the neighbourhood of Pimpri and Agricultural College Farm, Poona. On isolation by usual poured plate method, small, deep yellow pathogenic colonies appeared after 48 hours at 30° C. which when studied for morphological, cultural and biochemical characters was found to be a species of *Xanthomonas*. Artificial inoculation of healthy plants by spraying the water suspension of pure culture of the bacterium gave disease symptoms within eight days.

The pathogen incites three types of symptoms on the host: (i) A ring formation is seen when water-soaked areas with brown centre and pale yellow halo form a deep brown coloured periphery around each spot measuring 1-2 mm.; (ii) Sometimes, the brown centre of the water-soaked areas goes on increasing so rapidly that the yellow halo around each such spot is not able to keep pace with the increase in the size of deep brown spots and ultimately, only deep brown spots measuring 1-2 mm. are seen; and (iii) In advanced stages of heavy infection, the leaves become yellow and readily get detached from the plants. The infection spots increase in size to about 3-4 mm. leaving a parchy centre and deep brown periphery around them. The pathogen infects cotyledons and pods

1. Aiyer, S. P., *Indian Farming*, 1946, 7, 11.

2. Gericke, W. F., *Bot. Gaz.*, 1925, 83, 410.

3. Loomish and Shall, *Methods in Plant Physiol.*, (McGraw-Hill), 1937, p. 63.



besides leaves. The technical description of the pathogen is as follows:

Short rods; single polar flagellum; gram negative; capsulated; non-spore former; agar colonies circular with entire margin, smooth, butyrous, raised and barium yellow, measuring 20 mm. after 8 days on potato dextrose; gelatin liquefied; starch hydrolysed; casein digested; hydrogen sulphide and ammonia produced from peptone; indol not produced; milk peptonised and litmus reduced; good growth in synthetic nitrate and Czapek's media; nitrite and ammonia not produced from nitrate; acid without gas from arabinose, dextrose, lactose, sucrose and starch; no growth in salicin; optimum temperature for growth 27-30° C.; thermal death point about 51° C.

From the morphological, cultural and biochemical responses, it is difficult to distinguish the *Xanthomonas* species under study from other *Xanthomonas* species. When host range of related and unrelated plants was tried it was observed that the pathogen is specific to *L. pusilla* only. Since there is no record of a *Xanthomonas* species on Apocynaceae and as the pathogen is highly specific to its suspect, it is proposed to designate it a new species *Xanthomonas lochnerae*.

Fuller details will be published elsewhere.

M. K. PATEL.

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Poona-5, October 7, 1954.

#### A NEW METHOD FOR THE STUDY OF CERCARIAE

The cercariae are usually studied alive either stained with vital dyes or unstained, the normal methods of fixing and subsequent staining being rather unsatisfactory. All these methods were disappointing with the amphistome cercariae of the Pigmentata group. The presence of a large amount of dark brown pigment and cystogenous cells prevented the study of the internal organs, particularly the rudiments of the genital system when the cercariae are studied alive. The brown pigment can of course be bleached, but even then the cystogenous cells interfere with staining. While the author was studying the life-history of an amphistome of cattle, a method was evolved which makes the study of internal organs possible. A drop of aceto-carmine (45 per cent. glacial acetic acid

boiled with excess of carmine and filtered) is placed on a slide on which live cercariae are transferred and manipulated with steel needles to add the necessary amount of iron. After about 2 minutes a No. 0 cover glass is placed on the drop and the preparation is ready for examination. The aceto-carmine kills the cercariae in relaxed condition, dissolves the brown pigment, the cystogenous cells and the excretory granules, and at the same time fixes and stains the various organs. If necessary, the excess of stain can be washed with a drop of acetic acid (45 per cent. glacial). But it was found that permanent preparations are unsatisfactory. The author has used this method for a number of years with amphistome and other types of cercariae with great success.

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The University,  
Lucknow, October 27, 1954.

#### UTILIZATION OF NATURAL BYPRODUCTS FOR THE CULTIVATION OF BLUE-GREEN ALGAE

THE work of Allen,<sup>1</sup> Gross<sup>2</sup> and Harvey<sup>3</sup> has proved the importance of trace elements as essential auxiliaries of the major nutrients, Ca, K, Mg, Na, Cl, S, P and N in the metabolism of planktonic organisms including diatoms. In their studies extracts of *Ulva* and *Fucus*, unsuspected as sources of trace elements, were actually found to induce the growth in cultures of diatoms in artificial sea-water. It has been shown elsewhere<sup>4</sup> that the maximum growth of blue-green algae of salt water lagoons is dependent upon definite proportions of trace elements Mn, B, Cu, I, Fe, etc., besides those of the major nutrients mentioned above and that the soluble extracts from the sea-weeds are rich in these trace elements. The information is no doubt helpful, yet the addition of chemicals to increase the plankton would be costly and at present of little practical value in India. Cheap fertilizers and byproducts will have to be explored for this purpose. The present communication deals with the attempts made to utilize oilcakes, sea-weed composts and the wastes in the industries involving sea-weeds of high trace element content as possible sources as fertilizers for the production of fish food.

The artificial sea-water media were prepared according to the formula given by Lyman and Fleming.<sup>5</sup> The cold water-soluble portions of two oilcakes, viz., gingelly oilcake and groundnut oilcake, were used in one series, that of



TABLE I  
Trace element content of the substances used in cultures  
(Expressed as mg. per kg. of dry material)

Material used	Mn		B		Cu		I		Mo		Fe	
	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.	Total	W.S.
<i>Oilcakes:</i>												
Gingelly oil cake	74	..	nil	..	..	..	nil	..	..	..	32	..
Groundnut oil cake	16	..	nil	..	..	..	nil	..	..	..	25	..
<i>Sea-weed composts:</i>												
<i>Hypnea</i> + cow dung	105	28	5.8	1.2	trace	nil	18	trace	0.10	trace	102	14
<i>Hypnea</i> + fish waste	84	26	4.2	0.9	trace	nil	28	trace	0.10	trace	84	12
+ cow dung												
<i>Sargassum</i> + cow dung	44	15	2.8	trace	2.1	nil	100	18	..	nil	60	8
<i>Sea-weeds:</i>												
<i>G. lichenoides</i>	550	160	12.8	2.0	10.0	3.0	119	20	0.24	0.08	70	12
<i>C. dasyphylla</i>	155	50	8.5	1.0	6.0	1.8	90	12	0.10	0.05	186	32
<i>L. papillosa</i>	240	100	4.4	0.4	3.8	1.2	trace	trace	0.05	trace	140	40
<i>H. musciformis</i>	195	95	7.5	1.0	nil	nil	trace	trace	0.09	trace	172	35

three sea-weed composts (*Hypnea* + cow dung; *Hypnea* + fish waste + cow dung and *Sargassum* + cow dung) in another and that of four species of sea-weeds, viz., *Gracilaria lichenoides*, *Chondria dasyphylla*, *Laurencia papillosa* and *Hypnea musciformis* in a third series.

The quantity of the various trace elements present in the water-soluble portions of the above was determined by analysing separately the extracts prepared from 5-10 g. of the samples. The total trace element content and the amounts in the water-soluble portions are tabulated in Table I.

To 10 ml. of the media in petri dishes were added 1, 2 and 3 ml. of the sterilized extracts separately. To these dishes equal quantities of an algal association (5 mg.) from a stock culture were inoculated. The composition of the algal association was as follows:

*Phormidium tenue* (Menegh.) Gom.—dominant.

*Phormidium ambiguum* Gom.—common.

*Microcoleus chthonoplastes* Thuret.—common.

*Nitzschia vitrea* Norman.—sub-dominant.

*Nitzschia seriata*—rare.

*Gloeocapsa arenaria* (Hass.) Rabh. (also its nannocyst stage)—few

*Gymnodinium* sp. (Dinoflagellate)—rare.

The growth obtained in the controls and in the treatment vessels after one month was estimated separately and the results are tabulated in Table II.

It may be seen from Table I that in the case of almost all the trace elements nearly 30 per cent. are present in a water-soluble form, and

that all the algæ screened are sufficiently rich in trace elements except *L. papillosa*. Table II affords evidence of good growth of algæ in the treatment vessels, especially those treated with

TABLE II  
Weight of algæ obtained from different treatment vessels\*

Source of trace elements	Control Wt. in g.	1 ml. of extract		2 mls. of extract		3 mls. of extract	
		Wt. in g.	Chlorophyll	Wt. in g.	Chlorophyll	Wt. in g.	Chlorophyll
<i>Hypnea</i> + cow dung	nil	0.015	25	0.042	85	0.060	120
<i>Hypnea</i> + cow dung + fish waste	nil	0.015	30	0.040	85	0.052	105
<i>Sargassum</i> + cow dung	nil	0.012	20	0.024	50	0.040	95
Gingelly oil cake	..	0.009	..	0.012	25	0.018	40
Groundnut oil cake	..	0.006	..	0.010	..	0.012	30
<i>G. lichenoides</i>	0.008	0.023	40	0.045	95	0.076	185
<i>C. dasyphylla</i>	0.007	0.032	65	0.048	95	0.083	200
<i>L. papillosa</i>	nil	0.015	20	0.029	65	0.056	95
<i>H. musciformis</i>	0.008	0.020	40	0.040	90	0.073	150

\* Average from three series of trials.

the extracts from *G. lichenoides*, *C. dasyphylla* and *H. musciformis*. There was similarity in the cultures in species composition. The extracts from the two oilcakes do not seem to favour the growth of the algæ to any appreciable extent. This may be because of the absence of several of the essential trace elements in them as may be seen from Table I.

My grateful thanks are due to Dr. N. K. Panikkar, for his keen interest in the work and to Dr. (Mrs.) F. Thivy for the identification of the algæ.

Central Marine Fisheries Res. Station,  
Mandapam Camp, October 25, 1954.

V. KRISHNA PILLAI.

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# NEUROSECRETORY CELLS IN *PARATELPHUSA HYDRODROMOUS* (HERBST)

NEUROSECRETORY cells, i.e., neurones with pronounced glandular activity have recently been discovered in some Decapod Crustacea (Enami,<sup>1</sup> Bliss and Welsh,<sup>2</sup> Knowles,<sup>3</sup> Bliss, Durand and Welsh<sup>4</sup> and Matsumoto<sup>5</sup>). They are described to be endocrine centres in the central nervous system. Their physiological activity has been studied by Bliss<sup>6</sup> in *Gecarcinus*, Knowles<sup>3</sup> in *Leander*, Carlisle and Dohrn<sup>7</sup> in *Lysmata* and Enami<sup>8</sup> in *Sesarma*.

- × A-cell
- B-cell
- C-cell

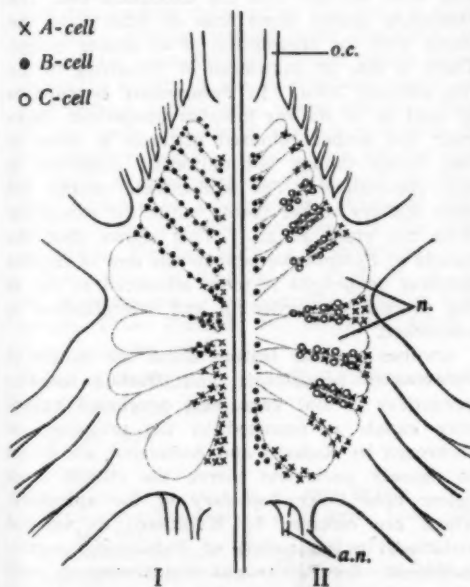


FIG. 1. Diagram to illustrate the distribution of the neurosecretory cells in the thoracic ganglion of *Paratelpusa hydrodromous*. (i) Dorsal view, (ii) Ventral view. The position of the C-cells is illustrated only in (ii), but these cells do not occur at the surface. o.c., oesophageal commissure; n., neuropiles; a.n., Abdominal nerves.

A study of the distribution and structure of the neurosecretory cells in the central nervous system of the common fresh-water crab, *Paratelpusa hydrodromous* (Crustacea, Brachyura) was recently started in this Department. The central nervous system of this crab contains three types of neurosecretory cells, designated A, B and C, distinguished by their size, cytoplasmic contents and nature of vacuoles. All these types occur in the thoracic ganglion while the brain and the tritocerebral connective ganglia contain only the A and B types. The distribution of these cells in the thoracic ganglion is given in Fig. 1. Of the three types the A cells are the most conspicuous (Fig. 2). They



FIG. 2. Giant neurosecretory cells (A-type) showing the minute dark cytoplasmic granules and axons. Photomicrograph, × 300. Fixation, Susa; Mallory's triple stain. are giant cells corresponding to the A cells of *Eriocheir* (Matsumoto<sup>5</sup>) but much larger. They measure about 150-60 μ in diameter. Under the phase-contrast microscope, their live cytoplasm shows myriads of tiny granules appearing greyish and a large number of tiny sphere-like bodies somewhat variable in size and appearing black. These granules and spheroids are traceable along the axons. The nucleus is large and rounded with a large nucleolus, the darker bodies of the chromocentres scattered here and there and minute granules. In addition, the

cytoplasm possesses a number of vacuoles which are different from the spheroids and larger in size. The spheroids of the cytoplasm show up in Aoyama preparations and Baker's Sudan-black technique as excellent black rings showing the deposit of argentophil and Sudanophil structure on their walls. In fixed preparations, a number of small vacuoles are seen, some of which are traceable along the axons as well. The height of secretory activity is indicated by large vacuoles all along the periphery of the cell. Another important aspect noticed is the relative abundance of the secretory materials in gravid and ovigerous females and the presence of a large number of peripheral vacuoles. The secretory products are stained dark blue in Gomori's chrome-haematoxylin-phloxin and bright red in Heidenhain's Azan.

Further details will be published elsewhere. Zoology Lab., R. PARAMESWARAN.  
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October 16, 1954.

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#### SOME PECULIARITIES OF THE STRUCTURE OF THE CUTICLE OF SOME INDIAN SCORPIONS

IN a former paper the author<sup>0</sup> described the occurrence of the openings of the dermal glands in the cuticle of *Palamnaeus bengalensis* and *Buthus tamulus gangeticus*.

The presence of the outermost layer, namely, an epicuticle in the cuticle of some arthropods as reported by Langner<sup>1</sup> for the Diplopoda and Cloudsley-Thompson<sup>2</sup> for the Myriapoda has been questioned by Blower<sup>1</sup> who considered that the appearance of this layer was merely a diffraction effect. Krishnan<sup>3</sup> claimed a very thin epicuticle bounded externally by a still thinner membrane in *Palamnaeus swammerdami* which he demonstrated as staining blue with Mallory and haematoxylin. During the course of an investigation on the cuticle of scorpions at Lucknow the writer did not notice the presence of any thinner membrane bounding the epicuticle externally which will stain blue with Mallory or haematoxylin. The epicuticle in

*Palamnaeus bengalensis* and *Buthus tamulus gangeticus* however is very thick in contrast to a thin and flimsy epicuticle of *Palamnaeus swammerdami*. It appears light greenish yellow in colour and takes no stain either with Mallory or haematoxylin. It is as usual further distinguished from the rest of the cuticle by being non-chitinous. It is also double-layered, an outer dried varnish like very resistant epicuticle consisting of bound lipoids in it which are liberated as oil droplets on heating with concentrated chlorated nitric acid and an inner layer which is not so resistant and dissolves without heating in concentrated chlorated nitric acid in few minutes or in about 2 hours in concentrated nitric acid alone leaving vertical striations referred to latter. The inner layer in contrast to the outer layer stains intensely with Sudan IV. In *Buthus tamulus gangeticus* however the comparatively thicker epicuticle layer has its outer surface very uneven and produced into denticular projections all over.

Further the exocuticle in *Buthus tamulus gangeticus* is very thin but is very well developed in *Palamnaeus bengalensis* and *Palamnaeus swammerdami*. Krishnan<sup>3</sup> describes that in *Palamnaeus swammerdami* the endocuticle stains blue with Mallory and the exocuticle red. The exocuticle shows some loss of affinity to the stains with the resumption of an amber colour. There is also an indication of inpushing of the red staining zone. In *Palamnaeus bengalensis* as well as in *Buthus tamulus gangeticus*, however, the amber coloured material is more or less feebly though not uniformly dispersed in the endocuticle. The endocuticle stains red with Mallory rather feebly while the exocuticle does not stain at all. This shows that the cuticle of *Palamnaeus bengalensis* and of *Buthus tamulus gangeticus* is more advanced so far as the process of hardening and sclerotization is concerned.

Another peculiar feature about the cuticle of *Palamnaeus bengalensis* and *Buthus tamulus gangeticus* is that very well developed helical pore canals as reported in the pronotum of cockroach by Richard and Anderson<sup>6</sup> are found to densely pack and pierce the cuticle from below upto inner boundary of the epicuticle. These are referred by Krishnan<sup>3</sup> as vertical striations in the cuticle of *Palamnaeus swammerdami*. In *Palamnaeus bengalensis* as well as *Buthus tamulus gangeticus* these do not take a straight course but run in a spiral fashion (Figs. 1 and 2). This character of the pore canals finds best expression in the well

developed exocuticle of the former where prominent spirals of greater diameter and pitch can be seen very clearly in fresh sections treated with Millon's reagent for about 4 hours. In *Buthus tamulus gangeticus* these end in peculiar funnel-shaped dilations (Fig. 2) beneath the epicuticle.

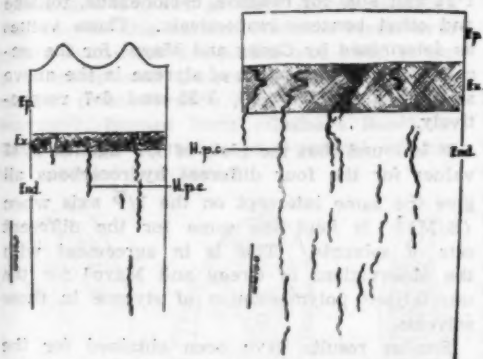


FIG. 2

FIG. 1

FIG. 1. T.S. of the cuticle of *Palamnaeus bengalensis*. FIG. 2. T.S. of the cuticle of *Buthus tamulus gangeticus*. Ep.—Epicuticle, Ex.—Exocuticle, End.—Endocuticle, H.p.c.—Helical pore canal.

cle. That these canals are not merely solid rods but contain cytoplasmic filaments is shown by their getting stained with Delafield and Heidenhain hæmatoxylin. These canals appear distinctly brown in the exocuticular region and also reduce ammoniacal silver nitrate. These do not seem to extend beyond exocuticle but in transverse sections which were left for about 2 hours in concentrated nitric acid or for a few minutes in concentrated chlorated nitric acid vertical striations are seen in the inner epicuticle. Further work is in progress.

The writer is thankful to Prof. M. B. Lal for guidance and to the Scientific Research Committee, Uttar Pradesh, for providing funds to carry out the work.

Dept. of Zoology, S. C. SHRIVASTAVA.  
The University, Lucknow,  
July 19, 1954.

# OCCURRENCE OF LYCORINE IN THE BULBS OF *CRINUM LATIFOLIUM* LINN.

THE occurrence of lycorine in the bulbs of *C. deflexum* and its isolation from this source have been reported in a recent communication from these laboratories.<sup>1</sup> Examination of the bulbs of *C. latifolium* Linn. along similar lines has revealed that the same alkaloid is present in this species also and indeed to a slightly greater extent than in *C. deflexum* (0.07 per cent. in *C. latifolium* as against 0.053 per cent. in *C. deflexum*). The isolation was achieved in the following manner: The minced bulbs of *C. latifolium*, after fermentation in a nitrogen atmosphere at room temperature, were extracted with alcohol. The alcoholic extract was partially concentrated, shaken with lead hydroxide and filtered. The filtrate, after adjustment of the reaction to pH 6 and further concentration, was extracted with petroleum ether and ether in succession. After elimination of all alcohol from the residual aqueous alcoholic extract by evaporation under reduced pressure, it was further extracted with chloroform and chloroform-alcohol (2:1). Lycorine could be obtained by direct crystallisation from the residues representing the ether-extract, the chloroform-extract and the chloroform-alcohol (2:1) extract. The main aqueous solution was rendered alkaline with solid potassium carbonate and extracted again with chloroform and chloroform-alcohol (2:1). From this chloroform-extract also lycorine was obtained by direct crystallisation.

The identity of the alkaloid was established by the following properties: m.p. 272-74° (decomp.),  $[\alpha]_D^{30} = -96.2 \pm 3^\circ$  in absolute alcohol. Its analysis agreed with the formula  $C_{10}H_{17}O_4N$ . The acetate prepared using acetic anhydride and pyridine melted at 218-20° C, had  $[\alpha]_D^{30} = +21.8 \pm 4^\circ$  in chloroform, and analysed for the formula  $C_{20}H_{31}O_6N$ . The mixed melting point of this acetate with lycorine acetate obtained from *C. deflexum*<sup>1</sup> was undepressed. Further details will be published elsewhere.

We thank Dr. B. N. Mulay of Birla College, Pilani, for the supply of authentic plant material.

Dept. of Pharmacy,  
Andhra University,  
Waltair, October 8, 1954.

S. RANGASWAMI.  
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# CHAIN-TRANSFER IN THE BENZOYL PEROXIDE CATALYSED POLYMERISATION OF STYRENE IN VARIOUS SOLVENTS

SCHULZ AND HUSEMANN<sup>1</sup> have shown that the initial rate of polymerisation in the benzoyl peroxide catalysed polymerisation of styrene in toluene is accurately represented by the law:

$$-\frac{dM}{dt} = k_0 B^{1/2} M^{3/2} \quad (1)$$

Josefowitz and Mark<sup>2</sup> have also shown that the initial rate varies with monomer concentration according to the following equation:

$$-\frac{dM}{dt} = k \cdot \frac{B^{1/2} M^{3/2}}{[1 + K(M)]^{1/2}} \quad (2)$$

The above expressions are based on a bimolecular initiation reaction. The following equation has been derived between the reciprocal of the degree of polymerisation ( $1/\bar{P}$ ) and the chain-transfer constant (C):

$$\frac{1}{\bar{P}} = \frac{(k_i k_t)^{1/2} B^{1/2}}{k_p M^{1/2}} + \frac{k_{tr}}{k_p} + C \cdot \frac{S}{M} \quad (3)$$

This relationship has been made use of in evaluating the method of the determination of chain-transfer constants of styrene in four hydrocarbons in presence of small quantities of benzoyl peroxide as catalyst at 60 and 80° C.

In our studies we have shown that the transfer constants (C), calculated from the slope of  $1/\bar{P}$  against S/M plots at constant values of

(B/M)<sup>1/2</sup> are not appreciably affected by the presence of low concentrations of benzoyl peroxide. This is illustrated in Fig. 1, for the set of determinations at 60° C. The values of chain-transfer constants at 60° as determined from these plots have been found to be 0.23, 0.31, 1.21 and 7.00 for benzene, cyclohexane, toluene and ethyl benzene respectively. These values as determined by Gregg and Mayo<sup>3</sup> for the uncatalysed polymerisation of styrene in the above solvents are 0.18, 0.24, 1.25 and 6.7 respectively.

It is found that the plots of  $1/\bar{P}$  against S/M values for the four different hydrocarbons all give the same intercept on the  $1/\bar{P}$  axis when (B/M)<sup>1/2</sup> is kept the same for the different sets of solvents. This is in agreement with the observations of Gregg and Mayo<sup>3</sup> for the uncatalysed polymerisation of styrene in these solvents.

Similar results have been obtained for the polymerisations at 80° C. The study of chain-transfer of styrene with various halogenated hydrocarbon solvents is in progress and the detailed paper will be published elsewhere in due course.

The best thanks of the authors are due to Prof. A. C. Chatterji for facilities, and to the Scientific Research Grants Committee, U.P., for a fellowship to R. N. C.

Dept. of Chemistry,  
Lucknow University,  
Lucknow, September 13, 1954.

R. N. CHADHA.  
G. S. MISRA.

1. Schulz and Husemann, *Z. Phys. Chem.*, 1936, **348**, 187.
2. Josefowitz and Mark, *Polymer. Bull.*, 1945, **1**, 140.
3. Gregg and Mayo, *Faraday Soc. Discussion*, 1947, **2**, 328.

## LIFE-HISTORY OF *COLDENIA PROCUMBENS* LINN.

THE anther, in its structure, shows epidermis, two wall-layers, secretory type of anther tapetum of parietal origin surrounding the sporogenous tissue. The tapetal cells are two-nucleate. The division of the pollen mother-cells is simultaneous. Cytokinesis takes place by furrowing. Both tetrahedral and bilateral tetrads are found. Pollen grains are two-nucleate at the time of shedding. They show three germ pores in the exine. In a few flowers the corolla did not drop off but persisted in a shrivelled up condition enclosing the anthers. Many of the pollen grains contained within the anther lobes of these flowers germinated in situ.

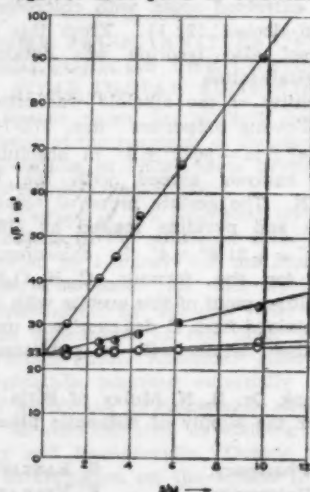


FIG. 1. Temp. 60° C.

Value of (B/M)<sup>1/2</sup>  $22.72 \times 10^{-3}$

○ Benzene; ◻ Cyclohexane; ◻ Toluene;  
● Ethyl benzene



The ovule is hemianatropous, unitegmic and tenuinucellate. The innermost layer of cells of the integument forms the endothelium. Unlike sympetalae in general, here the primary archesporial cell undergoes a mitotic division resulting in the formation of an upper primary parietal and a lower primary sporogenous cell (Fig. 1). In this feature *Coldenia procumbens* departs from most sympetalae and adds to the list of exceptional sympetalae such as Plumbaginaceae (Maheshwari<sup>1</sup>), *Convolvulus arvensis* (Mathur<sup>2</sup>), *Ipomea learii* (Raghava Rao<sup>3</sup>), in which also the formation of a parietal cell has been recorded previously.

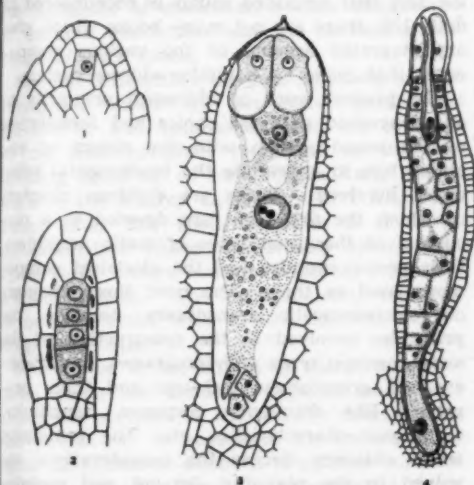


FIG. 1. L.S. of an ovule showing megaspore mother cell,  $\times 725$ . FIG. 2. L.S. of upper part of ovule showing a linear tetrad of megaspores,  $\times 725$ . FIG. 3. L.S. of ovule showing an embryo-sac,  $\times 435$ . FIG. 4. L.S. of ovule showing the endosperm with micropylar and chalazal haustoria,  $\times 480$ .

Usually the archesporium is one-celled. A linear tetrad is formed (Fig. 2) and the chalazal megaspore of the tetrad is functional. An

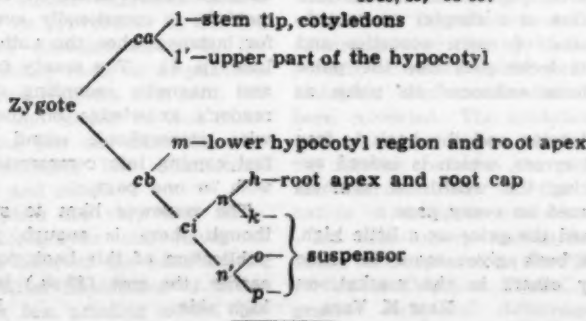
eight-nucleate embryo sac is developed according to the Polygonum type. The synergids are hooked. Antipodals disappear just before fertilisation. The egg and the embryo sac contain starch grains (Fig. 3).

Fertilisation is porogamous. Endosperm is of cellular type. The first division of the primary endosperm nucleus divides the embryo sac into a micropylar and a chalazal chamber. The micropylar chamber divides transversely and forms two chambers one above the other. The upper containing the fertilised egg undergoes two vertical divisions at right angles to one another and results in four cells. These elongate and form the micropylar haustorium while the chalazal chamber becomes two-nucleate due to a nuclear division in it. Eventually, however, the two nuclei fuse and this binucleate cell functions as the chalazal haustorium. The middle cell divides many times, each division being followed by the formation of a cell-wall. Thus a mass of cellular tissue is produced, forming the bulk of the endosperm. The endosperm shows three regions, namely, the micropylar haustorium, cellular endosperm tissue and the one-celled binucleate chalazal haustorium.

The embryo development has been studied in detail. The first division of the zygote takes place after the micropylar and chalazal haustoria are fully differentiated and the cellular endosperm tissue is well developed in the central chamber (Fig. 4). The development of the embryo is schematically represented below and it conforms to the Chenopodiad type.

Dept. of Botany, J. VENKATESWARLU.  
Andhra University, B. ATCHUTARAMAMURTI.  
Waltair, August 31, 1954.

1. Maheshwari, P., *An Introduction to the Embryology of Angiosperms*, 1950, McGraw-Hill Book Co., N.Y.
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## REVIEWS

**Acoustics.** By Dr. Leo L. Beranek. (McGraw-Hill), 1954. Pp. x + 484. Price \$9.00.

In the twelve years that have elapsed since the first edition of Prof. Philip Morse's book, *Vibration and Sound*, appeared, there has been no rival to it as a text-book for Degree courses in colleges and universities. Prof. Beranek's new book, *Acoustics*, is a strong contender for the same honour.

Beranek needs no introduction to students and research workers in acoustics. For more than a decade, he has published, sometimes singly, often in collaboration, a good many papers on a variety of topics and his first book, *Acoustical Measurements*, published five years back, is almost a classic. The book under review has grown naturally out of the courses. Beranek has conducted at the M.I.T. and Harvard in recent years.

The volume has been written frankly as a text-book and is indeed, a boon to the college instructor. The subject-matter is so arranged that the lecturer's task is made easy by maintaining a balance between theory and experimental results. The author has thoughtfully included suggestions for instructors giving a rough division of the course in acoustics. The worked-out examples at the end of every topic and the set of graded problems for every chapter add to its value as a text-book. However, the volume is more than a mere text-book. There is a wealth of experimental data in the collection of which the author himself has taken a leading part. There are also copious references to the latest research papers on the subject. However, the addition of a chapter on recording and a discussion of room acoustics and recent experimental techniques like the pulse technique would have enhanced its value as a text-book.

The get-up is pleasing and the book is free from typographical errors, which is indeed remarkable, considering the wealth of symbols and formulae scattered on every page.

Some might regard the price as a little high, but Dr. Beranek's book gives more for nine dollars than many others in the market, on the same subject.

RAM K. VEPA.

**The Amplification and Distribution of Sound.** Third Edition. By A. E. Greenless. (Chapman & Hall), 1954. Pp. 300. Price 35 sh.

This is a general text on the subject of what is often called by the less descriptive terminology, "Public Address Systems". In spite of the fact that amplified sound is encountered in daily life, there are not many books which give an integrated account of the various components that make up a public address system.

The present work is addressed primarily to one concerned with the choice and installation of the sound system with the object of enabling him to appreciate the fundamental principles involved. There are eighteen chapters of which the first eight are devoted to a discussion of the usual types of audio amplifiers, their power supplies and the electrical components used in them. The next three chapters on electroacoustic transducers describe the principles involved in the construction of the more common types of microphones, loudspeakers and gramophone pick-ups and their properties like frequency response, sensitivity, directional characteristics, etc. The remaining seven chapters discuss the considerations involved in the planning, lay-out and maintenance of public address systems in auditoria, cinema theatres, open air, etc.

The author's attempt to bring together in this book a number of facts about several different units that comprise a sound system is commendable. The treatment, however, is for the most part, introductory rather than detailed, and, where it concerns the fundamentals, is occasionally even unsatisfactory, as for instance when the author introduces Ohm's Law (p. 6). The scanty four pages on optical and magnetic recording do not add to the reader's knowledge on these matters. Likewise, stereophonic sound systems which are fast coming into commercial use are dispensed with in one page.

The reviewer likes to stress again that although there is enough justification for the publication of this book for reasons mentioned earlier, the cost (35 sh.) is very much on the high side.

B. S. RAMAKRISHNA.

Stainless Iron and Steel, Vol. II. (*Microstructure and Constitution*.) By J. H. G. Monypenny. (Chapman & Hall), 1954. Pp. 330. Price 55 sh.

The volume under review has been ably edited by Prof. F. C. Thompson from the rough manuscripts and notes of illustrations prepared by the author before his death.

Chapter 1 deals with the structure and constitution of iron-chromium alloys with and without carbon. The author points out the difficulty due to hysteresis in determining the boundaries of the sigma phase in the temperature range of 780-810°C. He also discusses the influence of chromium on the sluggishness of carbide dissolution and the hardening response of such steels.

Chapter 2 describes the embrittlement of high chromium steels by prolonged heating at 400-500°C. and emphasizes that the evidence of the iron-chromium compound as the embrittling agent is, so far, only indirect. Recent work at the Kearny Laboratory in U.S.A. published after this book, indicates it to be a chromium-iron phase considerably richer than sigma in chromium and of a different crystallographic system. The particles can, however, be only detected with a new electron microscope technique.

In Chapter 3, the effects of nickel on chromium steels are discussed. Spatial model and isothermal sections of the ternary diagram are also presented. In regard to the formation of sigma in austenitic steels, it is pointed out that most, if not all, previous investigators have shown that sigma phase forms exclusively from the unstable ferrite and not from the austenite. The author thus emphasizes the view held only by one group of investigators.

Chapter 4 deals with intergranular corrosion especially in 18:8 stainless steels. After dealing with its cause, the methods of its detection and prevention, the author expresses doubts about the efficacy of its prevention in welding the titanium-stabilized stainless sheets by the niobium-stabilized welding rods, as emphasized in U.S.A. The next two chapters deal with the effects of manganese and silicon on iron-chromium steels, while the last one deals likewise with the ferrite stabilizers like aluminium, etc., and also copper and cobalt.

The first four chapters are very well illustrated with photomicrographs and have, of necessity, formed the bulk of the book material due to the industrial importance of these steels. Apart from a few printing errors, the

book is so well written that engineers and others who are not conversant with metallography can most easily follow it.

R. C. DESHPANDE.

High Polymers. Vol. V. Part I. (*Cellulose and Cellulose Derivatives*.) Edited by E. Ott, H. M. Spurlin and M. W. Grafflin. (Interscience Publishers, Inc.), 1954. Pp. xvi + 509. Price \$12.00.

A very welcome change in the second edition under review, is to break up the massive volume of the first edition into three parts of a more convenient size. There have also been of necessity some changes in the authors of some of the chapters. Much of the material has been rewritten to include the work done during the last 15 years. In various places the subject-matter has been re-arranged to achieve better continuity and avoid duplication. Throughout the book the policy seems to have been to emphasise the latest developments and wherever possible to condense earlier work in a review or merely refer to such reviews published elsewhere. This is certainly very desirable and has provided ample space for the discussion of recent work without making the book unwieldy.

In Chapter 3, the excellent historical survey of the chemical nature of cellulose and its derivatives by Purves remains largely unchanged. The review has been extended to include the recent postulates of weak acid-sensitive bonds in cellulose proposed by Husemann and Schultz and by Pacsu, and the criticism of these postulates by Mark and Tobolsky and by Jorgensen. The significance of alkali solubles has been rewritten and considerably expanded to include the work of Davidson and Nodder. Recent work on solubilities of  $\alpha$ ,  $\beta$  and  $\gamma$  celluloses in alkali under various conditions and the precautions necessary to interpret these data for technical use are also included. The section on "Degradation of Cellulose" has been admirably rewritten by McBurney and the important omissions, in the first edition, of microbiological and mechanical degradation, have been corrected. The oxidation of cellulose has been discussed from electronic concepts and the relation between the physical and inorganic characteristics of the oxidant and the nature of cellulose oxidation is given.

An introductory section by Mark has been added to Chapter 4 on the "Structure and Properties of Cellulose Fibres". Dealing with the general structural differences between high

polymers and ordinary organic compounds and the characteristic features of high polymer structure, this introduction serves as an excellent background for the rest of the chapter. An interesting detail is the change in terminology from native cellulose and mercerised cellulose to celluloses I and II. Omission of the secondary structure and cellulose particle theories has made it possible to discuss the Fringe-Micellar theory in greater detail. The chapter also gives an excellent review of the methods for determining the crystallinity and the present status of crystallinity concepts. The section on "Sorption of Water and Other Vapours on Cellulose" by Valko in the previous edition is replaced by "Structure Sorption Relations" by Howsmon in the present edition. A critical review of different sorption theories and an exhaustive account of the changes in the properties due to sorption are given.

The editors have done well in continuing their policy of selecting authors connected with both the industrial and the academic aspects of the cellulose field. In conclusion this book admirably fulfils their aim "to present the most important modern scientific and technical information concerning cellulose and its derivatives", and is sure to maintain a high place among the reference books in this field.

P. C. MEHTA.

**Name Reactions in Organic Chemistry.** By A. R. Surrey. (Academic Press, Inc.), 1954. Pp. viii + 192. Price \$ 4.00.

As organic chemistry has developed, a large number of organic reactions have come to be named after those chemists who either discovered or developed them. This book gives an account of about one hundred of the more well known of such name reactions. Each reaction is described and discussed in space not exceeding 2 pages, and preceding each description, there is a short biographical sketch of the chemist or chemists after whom the particular reaction is designated. While the discussions are admittedly not as exhaustive as are the chapters in 'Organic Reactions', the scope and limitations of the various reactions have been outlined briefly and further recent developments, if any, have been mentioned. All the leading references are given and with the help of these, it is an easy matter for anyone wishing to obtain more information about any particular reaction to do so. The biographical notes give a short account of the life, background and contributions to chemistry of the various che-

mists and the inclusion of these sketches is a particularly attractive feature of the present volume.

S. SWAMINATHAN.

**Weeds.** By Chandrika Thakur. (Published by Motilal Banarsidass, Patna), 1953. Pp. xv + 125. Price Rs. 7-8-0.

The book is divided into two parts. The eight chapters in Part I are meant to give the reader an idea of the classification of weeds, the losses caused by them and the methods of control. A certain amount of success has been achieved in the matter of details though one can normally expect a much higher standard of performance. Under 'Biological Control of Weeds' mention is made of the control of prickly pear in Australia. One misses reference to its control in South India. In Chapter III, it would have been helpful if examples had been given of the adaptations of fruits and seeds for dispersal and their mode of dissemination. A list of the implements in use in Bihar for weeding would have been welcome. The chapters on chemical control of weeds could have been more exhaustively dealt with.

Part II of the publication is an attempt to give information on weeds, their description, chromosome number, mode of propagation, control measures and economic importance. In this attempt the author has not fulfilled the expectations of a botanist. The order of description of the weeds neither follows a recognised system of classification nor an alphabetical order. The descriptions start with the family Cyperaceae and end with Cruciferae. The two subfamilies under Leguminosae, viz. Papilionaceae and Caesalpineeae are separated. One of the serious drawbacks of the book is that old botanical names are retained. In certain cases as *Coccinia indica*, old names are given prominence. Mention of *Sorghum halepense* as *Holcus halepensis* is an error.

Under the heading 'description' two paragraphs are given. The first deals with the distribution and habitat of the plant and should have been separated under a different heading. The term 'description' cannot cover distribution.

As for the description of the weeds, this is incomplete. In a publication in which the author claims "an attempt has been made to describe some important weeds and to compile as much information as he could", it is hardly justifiable to give a very sketchy description in 3 or 4 sentences. In some cases no attempt has been made to record the shapes and arrange-



ment of the leaves, the details of floral parts, the description of fruit and seed and the placentation of the ovary which are the more important characteristics used in identification of any plant. The author does not seem to have consulted the publication, *A Handbook of Some South Indian Weeds*, by C. Tadulingam and G. Venkatanarayana published more than two decades ago, which is perhaps the first pioneer attempt in India on description of weeds. In the above book, 46 of the weeds described in the publication under review have been dealt with in a more exhaustive and comprehensive manner.

Information regarding the economic importance of the weeds is very brief and far from being useful. In many cases the particular portion of the plant of economic use and the disease for which it is meant is not stated, which considerably reduces the importance of the information.

It is doubtful if in its present form the book will be of much use to students and teachers of botany and agriculture, but it is hoped that the defects noticed will be remedied in the next edition. Attempts should be made to bring down the cost of the book, which is rather high for the matter contained. **NAND LALL DUTT.**

**Indian Food Laws.** Published by N. V. R. Iyengar, B. K. Sur and G. T. Kale. (C.F.T.R.I., Mysore), 1954. Pp. iii + 220. Price Rs. 4-8-0.

Food adulteration control has not received the attention it deserves in India. Though a few provinces in British India had Statutory Acts, they were not effectively enforced. *The Law of Adulteration of Food and Drugs in British India*, by M. C. Mowar, published in 1937, gives a comparative account of the various Food Adulteration Acts then in force in eight provinces, besides some important legal decisions. In the following years also the working of the Act has been sporadic and there has been no uniformity in standards or in enforcement. But food adulteration being a concurrent subject, the Government of India have passed the Central Prevention of Food Adulteration Act recently and the future is hopeful.

The publication of the book under review at this juncture is timely and useful. It is much more than a compilation. It gives in about 200 pages a comparative account of the existing State Food Laws and Standards, Recommendations of the Central Committee for Food Standards, the Government of India Specifications

for food purchased for the Civil and Defence requirements and under the Vegetable Oil Products Control Order. The book serves to focus public attention on the inadequacy of the existing provisions and the necessity for enforcing the Acts more effectively. Public analysts, health authorities and those who are called upon to frame regulations and standards under the Central Act would find the book very useful as a reference book.

S. NARAYANIER.

**Table of Sine and Cosine Integrals for Arguments from 10 to 100.** NBS Applied Mathematics Series 32. (Re-issue of Mathematical Tables 13). (Order from the Govt. Printing Office, Washington-25, D.C.). Pp. 186. Price \$ 2.25.

The sine and cosine integrals have long played an important part in the theory of numbers and the calculus of probabilities. Lately, they have assumed increasing value in such fields as antenna theory, electromagnetic theory and nuclear physics.

This table contains  $Si(x)$  and  $CI(x)$ ,  $x = 10(0.1)100$ , 10 D. In addition there are auxiliary tables of multiples of  $\pi/2$ ,  $(\frac{1}{2}p)(1-p)$ ,  $p(1-p^2)/6$  and  $q(1-q^2)/6$  where  $p+q=1$ , to facilitate interpolation in the tables.

**Table of the Gamma Function for Complex Arguments.** NBS Applied Mathematics Series 34. (Order from the Govt. Printing Office, Washington-25, D.C.) Pp. 105. Price \$ 2.00.

This table is of fundamental importance in both pure and applied mathematics. The tabulation was prompted by urgent and specific needs in the fields of atomic and nuclear research. The results presented here make the complex gamma function as accessible to workers as the more familiar exponential and trigonometric functions. This table gives the real and imaginary parts of  $\log \Gamma(z)$  for  $z = x + iy$ ,  $x = 0(0.1)10$ ,  $y = 0(0.1)10$  each to 12 decimals.

A comprehensive introduction contains a discussion of the important properties of the gamma function with methods for extending the range of the table. Auxiliary tables of  $\sin \pi x$ ,  $\cos \pi x$ ,  $\sinh \pi x$  and  $\cosh \pi x$  are given to 15 decimal places or 15 significant figures for  $x = 0(0.1)10$  to facilitate extension of the scope of the table.



Report of the Rothamsted Experiment Station, Harpenden, for 1953. (1954), Pp. 227. Price 7 sh. 6 d.

The Report covers the work of the 15 departments of the Rothamsted Experiment Station during the year 1953 under the Directorship of Sir William G. Ogg. It includes, as in earlier years, an account of the progress of soil survey of England and Wales by Dr. D. W. King, and three special reviews. The Director's introduction gives in 12 informative pages a summary of the work done during the year.

Among the important results obtained during the year is the finding on the nature of interactions between certain micronutrients and iron: it has been found that the ill-effects of the excess of manganese and molybdenum, on flax, soyabean, etc., can, as in the case of vanadium, be counteracted by increasing the supply of iron. One of the special reviews gives a full account of these observations. The leaf spraying work has been extended to the study of the effects of concentration of the nutrient solution. Spraying with sulphate of potash solution has led to an increase in the potash content of lucerne. In spite of employing isotopes, it was not possible to account for the observed loss of a part of nutrients sprayed. Root diseases in potted wheat plants were significantly reduced by antibiotics produced by some strains of actinomycetes. The action of the latter, however, is often restricted by the adsorption of the antibiotics by the clay fraction. Some progress has been recorded in the work on nodule bacteria. Work on enzymes is continued on the three fronts, viz., investigations on ribonuclease whose action is connected with cell processes and virus infection; on enzymes responsible for the oxidation of amino-acid derivatives and plant hormones; and on those acting on cellulose and chitin. Basic research on viruses has progressed relating to the rate of virus multiplication and the effects of ultraviolet radiation. Heat therapy was partially successful against virus infection: an interesting observation is that only viruses of spherical shape are inactivated by heat treatment. Eel-worm control work is mainly directed towards finding resistant crop varieties, suitable crop rotations and the influence of root diffusates. Research on insect migration and on gall midges and aphids is continued. An interesting finding is that certain caterpillars grow more rapidly when crowded together. The physical properties and toxicity of DDT and some related compounds

has been dealt with in a special review. The finding that the behaviour of workers in honey-bee colonies and the cohesiveness to the colony is due to the influence of "a queen substance", which the workers have been found to obtain from the queen and distribute in the colony, is indeed fascinating. A special review on bees as pollinators appears in the report. Work on phosphates is being continued. Survey of clay minerals has disclosed one or two new constituents. It has been possible to characterise the clay mineral responsible for potash fixation. For the extraction of leaf proteins, machinery is being designed and installed with a view to starting production in the current year.

Appended to the Report is a list with abstracts of 186 publications including 4 books, 4 reviews, 3 reports, 5 general publications and 140 research papers, mostly published in 1953 and 1954.

The above summary is barely indicative of the range and importance of the researches undertaken. The Report in its informativeness and in its general function of clarifying step by step the complex processes in soil, plant and parasite relationships conforms to its usual high standard. In this respect, the reviewer has little to add to his comments on last year's Report. The work is not confined to the British Isles and apart from the Pedological researches extended to Kenya, several of the experts were engaged in surveys and fulfilled advisory functions in different parts of the Commonwealth during the year. Students who worked at Rothamsted will be glad to note that there has been an extension of working accommodation at the Station, particularly in the Plant Pathology and Statistics Departments.

NAND LALL DUTT.

#### Books Received

- Organic Analysis*, Vol. II. Edited by John Mitchel, Jr., I. M. Kolthoff, E. O. Proskauer and A. Weissberger. (Interscience Publishers, Inc.), 1954. Pp. viii + 372. Price \$ 8.50.
- Engineering Metallurgy*. By E. M. H. Lips. (Philips Technical Library.) [Agents in India: Philips Electrical Co. (India), Ltd., Calcutta-20], 1954. Pp. iii + 246. Price Rs. 22.
- The Biochemistry of Semen*. By T. Mann. (Methuen & Co., London), 1954. Pp. xii + 240. Price 16 sh.
- Chemical Specificity in Biological Interactions*. Edited by Frank R. N. Gurd. (Academic Press, Inc.), 1954. Pp. xv + 234. Price \$ 6.00.

**Optics—Lectures on Theoretical Physics.** By Arnold Sommerfeld. (Translated from German by Otto Laporte and Peter A. Moldauer), 1954. Pp. xii + 383. Price \$6.80.

**Technique of Organic Chemistry, Vol. I, Part 3.** (Physical Methods of Organic Chemistry.) Edited by Arnold Weissberger. (Interscience Publishers, Inc.), 1954. Pp. xi + 2097-2530. Price \$8.50.

**International Review of Cytology, Vol. III.** Edited by G. H. Bourne and J. H. Danielli. (Academic Press, Inc.), 1954. Pp. v + 530. Price \$9.50.

**Automatic Protection of A.C. Circuits.** Fourth Edition. Revised and Edited by C. M. Dodson. By G. W. Stubbings. (Chapman & Hall), 1954. Pp. xi + 355. Price 50 sh.

**The Sources of Eddington's Philosophy.** By Herbert Dingle. (Cambridge University Press), 1954. Pp. 63. Price 3 sh. 6 d.

**The Aboriginal Races of India.** By S. S. Sarkar. (Bookland Ltd., Calcutta-6), 1954. Pp. v + 151. Price Rs. 12.

**Mass Balancing of Aircraft Control Surfaces.** By H. Templeton. (Chapman & Hall), 1954. Pp. x + 241. Price 35 sh.

**The Plant Quarantine Problem.** By W. A. McCubbin. (Ejnar Munksgaard, Copenhagen), 1954. Pp. 255. Price 33 sh. 6 d.

**Valves for A. F. Amplifiers.** By E. Rodenhuis. (Philips Technical Library, Eindhoven, Distributors in India: Philips Electrical Co., 7, Justice Chandra Madhab Road, Calcutta), 1954. Pp. viii + 147. Price Rs. 5.

## SCIENCE NOTES AND NEWS

### Emergence of Buds in the Cultivated and Wild Species of *Oryza*

G. V. Chalam, Economic Botanist, Cuttack, reports that in the case of *O. sativa* and *O. glaberrima* the emergence of bud is intra-sheath or intra-vaginal (as termed by Agnes Arber), i.e., the bud is enclosed within the leaf-sheath. On the other hand, in *O. perennis* the emergence of bud is extra-sheath or extra-vaginal, i.e., the bud pierces through the base of the leaf-sheath and grows outside the leaf-sheath. In two more wild species, *O. coarctata* and *O. granulata* examined, it was found that in the former the emergence of bud is extra-vaginal and in the latter the emergence is intra-vaginal. The author feels that while formulating any hypothesis on the origin of the cultivated species of rice this feature also has to be borne in mind.

### Residual Toxicity of Some Organic Insecticides to Mustard Aphids

T. P. S. Teetia, Government Agricultural College, Kanpur, writes as follows:

In January 1954, a series of field tests was carried out to compare the residual effectiveness of endrin, lethane, lindane and parathion with nicotine for the control of the mustard aphid on sarson. The insecticides were applied at the rate of 1.8 lb. of 19.5 per cent. endrin emulsifiable concentrate, 0.7 lb. of lethane 60 (a 50 per cent. solution of thiocyanethyl laurate), 1.4 lb. of 25 per cent. wettable lindane,

1.0 lb. of 25 per cent. wettable parathion, and 3.0 lb. of nicotex "20" (a soapless emulsion spray containing 20 per cent. actual nicotine), per 100 gallons of water per acre.

These tests were preliminary in nature, but indicate that two sprayings, at intervals of about 20 days, with parathion and lindane at the dosages tested would give an effective control of the mustard aphid in a season. Further investigation is necessary, however, before definite recommendations can be made.

### Fermi Memorial Meeting

A public meeting in honour and memory of Enrico Fermi was held in Bombay on December 14, 1954. It was organized in the form of a symposium by the Tata Institute of Fundamental Research. The following speakers took part: P. A. M. Dirac—The Development of Fermi's Statistical Theory and of the Theory of  $\beta$ -Decay; D. D. Kosambi—Fermi's Theorem in Differential Geometry; K. S. Singwi—Slow Neutron Reactions and Reactor Development; B. Peters—Fermi's Theory of the Origin of Cosmic Rays; H. J. Bhabha—Fermi's Theory of Meson Production.

### Raptakos Fellowships Award

The Raptakos Medical Research Board Fellowships for the year 1955 have been awarded to the following persons: B. S. Narasinga Rao (Nutrition Research Laboratories, Coonoor); V. V. Patwardhan (Indian Cancer Research Centre, Parel, Bombay); B. N. Mody (Grant

Medical College and J. J. Group of Hospitals, Bombay); P. P. Nair (Department of Biochemistry, Institute of Science, Bombay); and Victor M. Rao (Department of Surgery, Christian Medical College Hospital, Vellore, S. India).

#### Hora Medal for Fishery Research

The Council of the National Institute of Sciences of India, on the recommendation of the Chandra Kala Hora Memorial Medal Advisory Board, have decided to award the medal for the quinquennial period 1950-54 jointly to Sri. G. N. Mitra, Director of Industries (formerly Deputy-Director of Fisheries), Orissa, and Sri. K. H. Alikunhi, Research Officer, Pond Culture, Central Inland Fisheries Research Station, Cuttack. This medal is awarded for "conspicuously important contributions to the development of fisheries in India", including all aspects of biological, technological and sociological studies, including also the improvement of fishing nets and crafts and the betterment of the social and economic conditions of the fishermen. In fact, its scope includes any discovery or invention or new practical method which tends to increase fishery production in India on a paying basis.

#### The Indian Society of Genetics and Plant Breeding, New Delhi

The Fifteenth Annual General Meeting of the Indian Society of Genetics and Plant Breeding was held at Baroda on 8th January 1955, under the Presidentship of Dr. S. M. Sikka, Head of the Division of Botany, Indian Agricultural Research Institute, New Delhi, who delivered his Presidential Address on "The Genetics of Wheat". The following were elected as office-bearers for the year(s) specified against each:

**President:** Dr. T. R. Mehta (1955); **Vice-Presidents:** Drs. P. N. Bhaduri and G. S. Murty (1955-56); **Secretary:** Dr. M. S. Swaminathan (1955-56); **Treasurer:** Dr. D. Chatterjee (1955-56); **Editor:** Dr. B. P. Pal (1955-57); **Councillors:** Drs. T. S. Venkataraman, N. Parthasarathy, B. S. Kadam, R. H. Richharia, Pushkarnath and P. D. Gadkari (1955-56).

#### Carcinogens in Cigarettes

In the course of an editorial on the subject, the *British Medical Journal* (Nov. 20, 1954, p. 1,213) observes that the formation of some polycyclic hydrocarbon carrying carcinogenic properties during smoking has now been confirmed. Referring to the 4 papers of Cooper, Lindsey *et al.*, who have made this important contribution to our knowledge, it points out

that these papers have shown the following, in order of publication: first, in cigarette smoke the polycyclic hydrocarbons, anthracene and pyrene, can be demonstrated by combined chromatography and spectrometry. Secondly, the conditions in the experiments simulated closely those of human smoking, and the temperatures encountered were those experienced in normal human smoking, being sufficiently high to account for the presence of polycyclic hydrocarbons. Thirdly, the tars from all-paper cigarettes (in which chopped cigarette paper replaced the tobacco) contain several polycyclic hydrocarbons, which have been identified, the most important being 3:4 benzpyrene. And fourthly, when sufficiently large quantities of ordinary cigarette tar were examined 3:4 benzpyrene was detectable. Thus they show that both the tobacco and the paper of cigarettes during smoking yield 3:4 benzpyrene.

#### Academy of Zoology, Agra

**Officers for 1955-57:** **President:** Dr. B. C. Mahendra; **Vice-President:** Dr. S. P. Jain; **Secretary:** Shri Surendra Sharma; **Treasurer:** Capt. R. P. Varma; **Member of the Council:** Shri C. P. Singh.

The Academy is an international organisation for the advancement of zoology in the East and is sponsoring the publication of a Journal entitled, *The Annals of Zoology*, from January 1955. Further particulars can be had from: The Secretary, Academy of Zoology, 164, Civil Lines, Agra (India).

#### Indian Phytopathological Society

The following Office-bearers have been elected to the Council of the Indian Phytopathological Society for 1955: **President:** Dr. K. D. Bagchee, Dehra Dun; **Vice-President:** Dr. M. J. Thirumalachar, Poona; **Councillors:** Drs. M. R. S. Iyengar, New Delhi; S. Sinha, Agra; S. Chowdhury, Jorhat; S. Vaheeduddin, Hyderabad Dn.; M. K. Patel, Poona; and T. S. Sadasivan, Madras; **Secretary-Treasurer:** Dr. R. Prasada, New Delhi.

#### Award of Research Degree

The Annamalai University has awarded the Ph.D. Degree in Chemistry to Sri. M. Balasubramanian for his thesis entitled "Synthesis of  $\beta$ -amino,  $\alpha\beta$ -unsaturated, and bisamino-aryl sulphones".

The Banaras Hindu University has awarded the Ph.D. Degree in Botany to Mr. J. N. Misra for his thesis on "Some Aspects of Indian Marine and Freshwater Algae".

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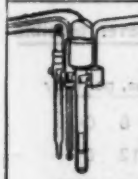
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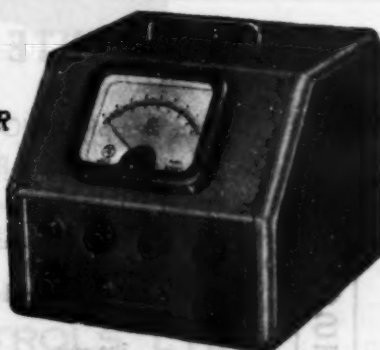
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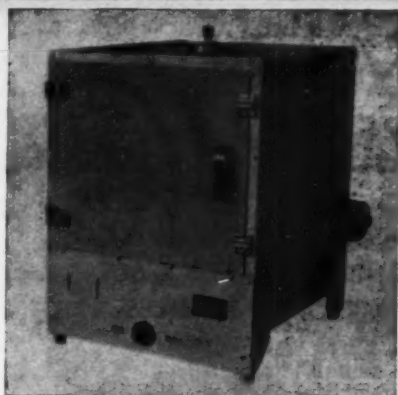
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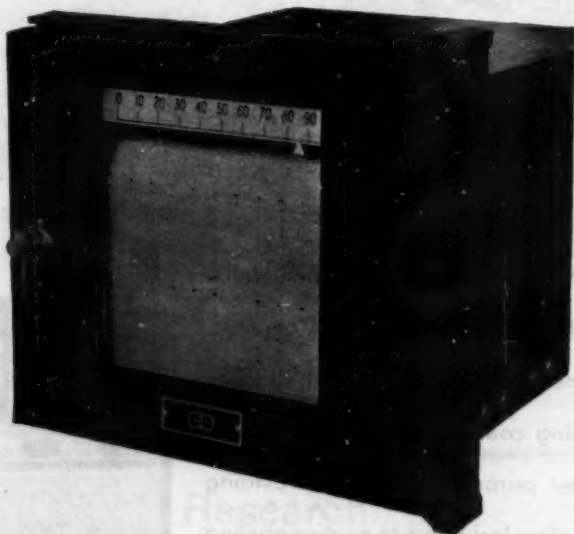
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